

V3800-TIE5B, D1803-CR-TE5B, V3307-CR-TE5B
ECU - DTC Code LIST

| DTC | ISO 14229 P-Code | J1939-73 | | SPN name SAE J1939 | Detection item | DTC set preconditions | DTC set parameter | Time to action or number of error detection | Limp home action by engine ECU (system action) | Remark | HMI behavior (Recommendation) | Engine warning light | Parked regen. if DTC occurred | Behavior during malfunction | Recovery from error | Delay time for recovery |
|---|------------------|----------|-----|--|---|---|---|---|---|--------------------------------|-------------------------------|----------------------|-------------------------------|---|---|---|
| | | SPN | FMI | | | | | | | | | | | | | |
| NE-G phase shift NE: Crankshaft position sensor G: Camshaft position sensor | P0016 | 636 | 7 | Engine Position Sensor | Large phase shift between NE pulse and G pulse | - Engine is operating low idle speed or more - Battery voltage is normal - Sensor supply voltage VCC# is normal - NE signal is normal - G signal is normal - Coolant temperature is 10 deg. C (50 deg. F) or more | (Approximately) Phase difference between NE pulse and G pulse is within +/-15 degree | 10 times or more | Output limitation: Approximately 75% of normal condition | | Yellow | ON | Inhibit | (Invalid G signal) - Engine hesitates at start-up | Diagnostic counter = zero or Key switch turn OFF | Delay time varies with engine speed in proportional relation 30 sec at 800 rpm 15 sec at 1600 rpm |
| High rail pressure | P0088 | 157 | 0 | Engine Injector Metering Rail 1 Pressure | Actual pressure exceeds the command pressure | - Rail pressure sensor is normal - Sensor supply voltage VCC# is normal | Actual pressure is 267 MPa (2723 kg/cm2, 38700 psi) or more | one sec or more | Engine stop | To minimize PM emission to DPF | Red | ON | Inhibit | - Engine stops | Diagnostic counter = zero or Key switch turn OFF | 30 sec |
| Fuel leak (in high pressured fuel system) or air bubbles in fuel line | P0093 | 1239 | 1 | Engine Fuel Leakage 1 | Fuel leak from high pressured fuel system (Fuel consumption is calculated from the difference of fuel pressure of before and after the injection, and the error will be detected when excess fuel consumption is found) | - Battery voltage is normal - Sensor supply voltage VCC# is normal - Rail pressure sensor is normal - Injector and injector drive circuit are normal - NE signal is active [Engine is operating (700 rpm or more)] - PRV is not in active, PCV is in active and normal | Flow-rate difference between "Fuel flow-rate calculated from dropped rail pressure" and "Other calculated flow-rate (volume of injection, leakage, pump discharge)" is more than 100 mm3/st | transient | Output limitation: Approximately 50% of normal condition Speed limitation (Accelerator limitation: 50%) EGR stop | To minimize PM emission to DPF | Red | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions - Engine stops in some cases | Key switch turn OFF | |
| Intake air temp. error: Low | P0112 | 172 | 4 | Engine Air Inlet Temperature | Ground short circuit of sensor or harness | - Battery voltage is normal | Voltage of intake air temperature sensor is 0.05 V or less | 2.8 sec or more | During start-up = -20 deg. C (-4 deg. F) [default value] Under other conditions = 40 deg. C (104 deg. F) [default value] | | Blue | ON | Inhibit | - White smoke increases at low temperature | Diagnostic counter = zero or Key switch turn OFF | 30 sec |
| Intake air temp. error: High | P0113 | 172 | 3 | Engine Air Inlet Temperature | Open circuit or +B short circuit of sensor or harness | - Battery voltage is normal | Voltage of intake air temperature sensor is 4.9 V or more | 2.8 sec or more | During start-up = -20 deg. C (-4 deg. F) [default value] Under other conditions = 40 deg. C (104 deg. F) [default value] | | Blue | ON | Inhibit | - White smoke increases at low temperature | Diagnostic counter = zero or Key switch turn OFF | 30 sec |
| Coolant temperature sensor: Low | P0117 | 110 | 4 | Engine Coolant Temperature | Ground short circuit of sensor or harness | - Battery voltage is normal | Voltage of coolant temperature sensor is 0.1 V or less | 2.8 sec or more | During start-up = -25 deg. C (-13 deg. F) [default value] Under other conditions = 80 deg. C (176 deg. F) [default value] Output limitation: Approximately 75% of normal condition EGR stop | | Yellow | ON | Inhibit | - White smoke increases at low temperature - Insufficient output - Worsening exhaust gas emissions | Key switch turn OFF | |
| Coolant temperature sensor: High | P0118 | 110 | 3 | Engine Coolant Temperature | Open circuit or +B short circuit of sensor or harness | - Battery voltage is normal | Voltage of coolant temperature sensor is 4.9 V or more | 2.8 sec or more | During start-up = -25 deg. C (-13 deg. F) [default value] Under other conditions = 80 deg. C (176 deg. F) [default value] Output limitation: Approximately 75% of normal condition EGR stop | | Yellow | ON | Inhibit | - White smoke increases at low temperature - Insufficient output - Worsening exhaust gas emissions | Key switch turn OFF | |
| Rail pressure sensor: Low | P0192 | 157 | 4 | Engine Injector Metering Rail 1 Pressure | Ground short circuit of sensor or harness Failure of sensor | - Battery voltage is normal - Sensor supply voltage VCC# is normal | Voltage of rail pressure sensor is 0.275 V or less | transient | Output limitation: Approximately 50% of normal condition Speed limitation (Accelerator limitation: 50%) EGR stop Engine forcibly stopped 60 sec later | To minimize PM emission to DPF | Red | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions - Engine running noise increases - White smoke increases - Engine stops | Key switch turn OFF | |
| Rail pressure sensor: High | P0193 | 157 | 3 | Engine Injector Metering Rail 1 Pressure | Open circuit or +B short circuit of sensor or harness Failure of sensor | - Battery voltage is normal - Sensor supply voltage VCC# is normal | Voltage of rail pressure sensor is 4.735 V or more | transient | Output limitation: Approximately 50% of normal condition Speed limitation (Accelerator limitation: 50%) EGR stop Engine forcibly stopped 60 sec later | To minimize PM emission to DPF | Red | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions - Engine running noise increases - White smoke increases - Engine stops | Key switch turn OFF | |
| Injector charge voltage: High | P0200 | 523535 | 0 | proprietary | Injector charge voltage: High ECU circuit failure | - Battery voltage is normal - CPU is normal | Injector charge voltage: High Failure of charge circuit of ECU | 10 sec or more | Output limitation: Approximately 75% of normal condition EGR stop Engine forcibly stopped 60 sec later | | Red | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions - Engine stops | Key switch turn OFF | |

| HMI behavior (Recommendation) | Warning | Caution | Engine stop |
|-------------------------------|---------|---------|-------------|
| Yellow | Blue | Yellow | Red |

| DTC | ISO 14229 P-Code | J1939-73 | | SPN name SAE J1939 | Detection item | DTC set preconditions | DTC set parameter | Time to action or number of error detection | Limp home action by engine ECU (system action) | Remark | HMI behavior (Recommendation) | Engine warning light | Parked regen. if DTC occurred | Behavior during malfunction | Recovery from error | Delay time for recovery |
|--|------------------|----------|-----|------------------------------------|--|--|---|---|---|--|-------------------------------|----------------------|-------------------------------|---|---|---|
| | | SPN | FMI | | | | | | | | | | | | | |
| Open circuit of harness or coil in 1st cylinder injector | P0201 | 651 | 3 | Engine Injector Cylinder #01 | Open circuit of harness Open circuit of injector coil | - Engine is operating - Battery voltage is normal - During injection - CPU is normal (VDIC2 is normal) | Open circuit of harness or Open circuit of injector coil | 8 times or more | Output limitation: Approximately 75% of normal condition EGR stop | To minimize PM emission to DPF Injectors which have no error are operated | | ON | Inhibit | - Insufficient output - Engine vibration increases - Worsening exhaust gas emissions | Key switch turn OFF | |
| Open circuit of harness or coil in 3rd cylinder injector | P0202 | 653 | 3 | Engine Injector Cylinder #03 | Open circuit of harness Open circuit of injector coil | - Engine is operating - Battery voltage is normal - During injection - CPU is normal (VDIC2 is normal) | Open circuit of harness or Open circuit of injector coil | 8 times or more | Output limitation: Approximately 75% of normal condition EGR stop | To minimize PM emission to DPF Injectors which have no error are operated | | ON | Inhibit | - Insufficient output - Engine vibration increases - Worsening exhaust gas emissions | Key switch turn OFF | |
| Open circuit of harness or coil in 4th cylinder injector | P0203 | 654 | 3 | Engine Injector Cylinder #04 | Open circuit of harness Open circuit of injector coil | - Engine is operating - Battery voltage is normal - During injection - CPU is normal (VDIC2 is normal) | Open circuit of harness or Open circuit of injector coil | 8 times or more | Output limitation: Approximately 75% of normal condition EGR stop | To minimize PM emission to DPF Injectors which have no error are operated | | ON | Inhibit | - Insufficient output - Engine vibration increases - Worsening exhaust gas emissions | Key switch turn OFF | |
| Open circuit of harness or coil in 2nd cylinder injector | P0204 | 652 | 3 | Engine Injector Cylinder #02 | Open circuit of harness Open circuit of injector coil | - Engine is operating - Battery voltage is normal - During injection - CPU is normal (VDIC2 is normal) | Open circuit of harness or Open circuit of injector coil | 8 times or more | Output limitation: Approximately 75% of normal condition EGR stop | To minimize PM emission to DPF Injectors which have no error are operated | | ON | Inhibit | - Insufficient output - Engine vibration increases - Worsening exhaust gas emissions | Key switch turn OFF | |
| Engine overheat | P0217 | 110 | 0 | Engine Coolant Temperature | Overheat of engine coolant temperature | - Coolant temperature sensor is normal | Engine coolant temperature is 120 deg. C (248 deg. F) or more | 5 sec or more | Output limitation: Approximately 75% of normal condition EGR stop | | | ON | Inhibit | - Insufficient output - Overheat | Diagnostic counter = zero or Key switch turn OFF | 30 sec |
| Engine overrun | P0219 | 190 | 0 | Engine Speed | Engine speed exceeds threshold speed | - Key switch is ON | Engine speed is 3500 rpm or more | 3 revolutions or more | Stop injection (Q = 0 mm3/st) | | | ON | Inhibit | - Overrun | Diagnostic counter = zero or Key switch turn OFF | Immediately |
| Boost pressure sensor: Low | P0237 | 102 | 4 | Engine Intake Manifold #1 Pressure | Ground short circuit of sensor or harness Failure of sensor | - Battery voltage is normal - Sensor supply voltage VCC# is normal | Voltage of boost pressure sensor is 0.2 V or less | 2.8 sec or more | 65 kPa (0.663 kg/cm2, 9.43 psi) [default value] | Default value is set in consideration with high altitude usage | | ON | Inhibit | - Insufficient output | Key switch turn OFF | |
| Boost pressure sensor: High | P0238 | 102 | 3 | Engine Intake Manifold #1 Pressure | Open circuit or +B short circuit of sensor or harness Failure of sensor | - Battery voltage is normal - Sensor supply voltage VCC# is normal | Voltage of boost pressure sensor is 4.9 V or more | 2.8 sec or more | 65 kPa (0.663 kg/cm2, 9.43 psi) [default value] | Default value is set in consideration with high altitude usage | | ON | Inhibit | - Insufficient output | Key switch turn OFF | |
| No input of NE sensor (Crank position sensor) pulse | P0335 | 636 | 8 | Engine Position Sensor | Open circuit or short circuit of sensor or harness Failure of sensor | - Battery voltage is normal - Sensor supply voltage VCC# is normal - Engine is not stalled | No recognition of NE sensor pulse | 10 times or more | Output limitation: Approximately 75% of normal condition | | | ON | Inhibit | (Running only with G signal) - Faulty starting - Engine vibration increases slightly - Insufficient output | Diagnostic counter = zero or Key switch turn OFF | Delay time varies with engine speed in proportional relation 30 sec at 800 rpm 15 sec at 1600 rpm |
| NE sensor (Crank position sensor) pulse number error | P0336 | 636 | 2 | Engine Position Sensor | Open circuit or short circuit of sensor or harness Failure of sensor | - Battery voltage is normal - Sensor supply voltage VCC# is normal - Engine speed is 350 rpm or more | Pulse count per rotation is not 56 teeth | 10 times or more | Output limitation: Approximately 75% of normal condition | | | ON | Inhibit | (Running only with G signal) - Faulty starting - Engine vibration increases slightly - Insufficient output | Diagnostic counter = zero or Key switch turn OFF | Delay time varies with engine speed in proportional relation 30 sec at 800 rpm 15 sec at 1600 rpm |
| No input of G sensor (Camshaft position sensor) pulse | P0340 | 723 | 8 | Engine Speed 2 | Open circuit or short circuit of sensor or harness Failure of sensor | - Battery voltage is normal - Sensor supply voltage VCC# is normal - Engine is not stalled | No recognition of G sensor pulse | 10 times or more | None | | | ON | Inhibit | (Invalid G signal) - Engine hesitates at start-up | Diagnostic counter = zero or Key switch turn OFF | Delay time varies with engine speed in proportional relation 30 sec at 800 rpm 15 sec at 1600 rpm |
| G sensor (Camshaft position sensor) pulse number error | P0341 | 723 | 2 | Engine Speed 2 | Open circuit or short circuit of sensor or harness Failure of sensor | - Battery voltage is normal - Sensor supply voltage VCC# is normal - Engine speed is 350 rpm or more | Pulse count per rotation is not 5 teeth | 10 times or more | None | | | ON | Inhibit | (Invalid G signal) - Engine hesitates at start-up | Diagnostic counter = zero or Key switch turn OFF | Delay time varies with engine speed in proportional relation 30 sec at 800 rpm 15 sec at 1600 rpm |
| +B short of starting aid relay driving circuit | P0380 | 523544 | 3 | proprietary | +B short of starting aid relay driving circuit | - Battery voltage is normal - During starting aid relay drive command is activated | +B short circuit of harness | 2 sec or more | None | | | ON | Inhibit | (At low temperature) - Faulty starting - White smoke increases | Key switch turn OFF | |
| Ground short of starting aid relay driving circuit | P0380 | 523544 | 4 | proprietary | Ground short or open circuit of starting aid relay driving circuit | - Battery voltage is normal - Other than during starting aid relay drive command is activated | Ground short or open circuit of harness | 2 sec or more | None | | | ON | Inhibit | (At low temperature) - Faulty starting - White smoke increases | Key switch turn OFF | |
| Oil pressure error | P0524 | 100 | 1 | Engine Oil Pressure | Oil pressure switch | - Battery voltage is normal - Key switch turn ON - Starter switch signal (ECU: V12 terminal) is not activated - 10 sec or more after engine start [700 rpm or more] | Oil pressure switch ON: continues one sec or more | transient | None | | | ON | Inhibit | - Engine stops | Key switch turn OFF | |

| HMI behavior (Recommendation) | Warning | Caution | Engine stop |
|-------------------------------|---------|---------|-------------|
| | | | |

| DTC | ISO 14229 P-Code | J1939-73 | | SPN name SAE J1939 | Detection item | DTC set preconditions | DTC set parameter | Time to action or number of error detection | Limp home action by engine ECU (system action) | Remark | HMI behavior (Recommendation) | Engine warning light | Parked regen. if DTC occurred | Behavior during malfunction | Recovery from error | Delay time for recovery |
|---|------------------|----------|-----|---------------------------------------|--|---|---|---|--|-----------------------------------|-------------------------------|----------------------|-------------------------------|---|---|-------------------------|
| | | SPN | FMI | | | | | | | | | | | | | |
| Battery voltage: Low | P0562 | 168 | 4 | Battery Potential / Power Input 1 | Open circuit, short circuit or damage of harness Failure of battery | - Key switch is ON - Starter switch signal (ECU: V12 terminal) is not activated | ECU recognition of battery voltage is 8 V or less | one sec or more | Output limitation: Approximately 75% of normal condition EGR stop Intake throttle 100% open | | | ON | Inhibit | - Faulty starting - Insufficient output - Worsening exhaust gas emissions - Engine stops in some cases | Diagnostic counter = zero or Key switch turn OFF | 30 sec |
| Battery voltage: High | P0563 | 168 | 3 | Battery Potential / Power Input 1 | Open circuit, short circuit or damage of harness Failure of battery | - Key switch is ON - Starter switch signal (ECU: V12 terminal) is not activated | ECU recognition of battery voltage is 16 V or more | one sec or more | Output limitation: Approximately 75% of normal condition EGR stop Intake throttle 100% open | | | ON | Inhibit | - Faulty starting - Insufficient output - Worsening exhaust gas emissions | Key switch turn OFF | |
| QR data error | P0602 | 523538 | 2 | proprietary | QR data read error | - Key switch is ON | QR data read error from EEPROM | transient | Nozzle correction is not executed Output limitation: Approximately 75% of normal condition | To cover each injector dispersion | | ON | Inhibit | - Insufficient output | Key switch turn OFF | |
| No QR data | P0602 | 523538 | 7 | proprietary | QR data is unwritten | - Key switch is ON | Area of QR data on EEPROM is vacant | transient | Nozzle correction factor = 0 [default value] Output limitation: Approximately 75% of normal condition | | | ON | Inhibit | - Insufficient output | Key switch turn OFF | |
| ECU FLASH ROM error | P0605 | 628 | 2 | Program Memory | FLASH ROM error (main-CPU) | - Key switch is ON | Check-sum error | one time or more | Engine stop | | | ON | Inhibit | - Engine stops | Key switch turn OFF | |
| ECU CPU (Main IC) error | P0606 | 1077 | 2 | Engine Fuel Injection Pump Controller | Failure of CPU | - Key switch is ON | Battery voltage is normal and "CPU has fatal error or sub-CPU has alert signal" | one time or more | Engine stop | | | ON | Inhibit | - Engine stops | Key switch turn OFF | |
| ECU CPU (Monitoring IC) error | P0606 | 523527 | 2 | proprietary | Failure of monitoring IC of CPU | - Key switch is ON | Battery voltage is normal and Failure of monitoring IC of CPU | one time or more | Engine stop | | | ON | Inhibit | - Engine stops | Key switch turn OFF | |
| Injector charge voltage: Low | P0611 | 523525 | 1 | proprietary | Injector charge voltage: Low Failure of charge circuit of ECU | - Battery voltage is normal - CPU is normal | Injector charge voltage: Low Failure of charge circuit of ECU | transient | Output limitation: Approximately 75% of normal condition EGR stop | To minimize PM emission to DPF | | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions - Engine stops in some cases | Key switch turn OFF | |
| Sensor supply voltage 1: Low | P0642 | 3509 | 4 | Sensor supply voltage 1 | Sensor supply voltage 1 error or recognition error | - Battery voltage is normal - Key switch turn ON - Starter switch signal (ECU: V12 terminal) is not activated | Voltage to sensor is 4.375 V or less | transient | Output limitation: Approximately 50% of normal condition Speed limitation (Accelerator limitation: 50%) EGR stop Intake throttle 100% open | Emission related | | ON | Inhibit | - Faulty starting - Insufficient output - Worsening exhaust gas emissions - Engine stops in some cases | Key switch turn OFF | |
| Sensor supply voltage 1: High | P0643 | 3509 | 3 | Sensor supply voltage 1 | Sensor supply voltage 1 error or recognition error | - Battery voltage is normal - Key switch turn ON - Starter switch signal (ECU: V12 terminal) is not activated | Voltage to sensor is 5.625 V or more | transient | Output limitation: Approximately 50% of normal condition Speed limitation (Accelerator limitation: 50%) EGR stop Intake throttle 100% open | Emission related | | ON | Inhibit | - Faulty starting - Insufficient output - Worsening exhaust gas emissions - Engine stops in some cases | Key switch turn OFF | |
| Sensor supply voltage 2: Low | P0652 | 3510 | 4 | Sensor supply voltage 2 | Sensor supply voltage 2 error or recognition error | - Battery voltage is normal - Key switch turn ON - Starter switch signal (ECU: V12 terminal) is not activated | Voltage to sensor is 4.375 V or less | transient | Output limitation: Approximately 75% of normal condition | Emission related | | ON | Inhibit | - Faulty starting - Insufficient output - Worsening exhaust gas emissions | Key switch turn OFF | |
| Sensor supply voltage 2: High | P0653 | 3510 | 3 | Sensor supply voltage 2 | Sensor supply voltage 2 error or recognition error | - Battery voltage is normal - Key switch turn ON - Starter switch signal (ECU: V12 terminal) is not activated | Voltage to sensor is 5.625 V or more | transient | Output limitation: Approximately 75% of normal condition | Emission related | | ON | Inhibit | - Faulty starting - Insufficient output - Worsening exhaust gas emissions | Key switch turn OFF | |
| Main relay is locked in closed position | P0687 | 1485 | 2 | ECM Main Relay | Failure of main relay | - Key switch turn OFF - Engine stops | After the self-power-off process of the main relay, +B voltage continues more than 75 seconds | transient | None | | | ON | Inhibit | - Battery goes dead | Diagnostic counter = zero or Key switch turn OFF | Immediately |
| Pump seizing 1 | P1274 | 523539 | 2 | proprietary | High pressure 1 error | - Sensor supply voltage VCC# is normal - Rail pressure sensor is normal | (Approximate parameter) Rail pressure of 300 MPa (3059 kg/cm2, 43500 psi) or more continues one sec under the condition of 500 rpm or more [Threshold changes depending on the engine speed. 2600 rpm should be used as a reference] | one time or more | Engine stop | | | ON | Inhibit | - Engine stops | Key switch turn OFF | |

| HMI behavior (Recommendation) | Warning | Caution | Engine stop |
|-------------------------------|---------|---------|-------------|
| | | | |

| DTC | ISO 14229 P-Code | J1939-73 | | SPN name SAE J1939 | Detection item | DTC set preconditions | DTC set parameter | Time to action or number of error detection | Limp home action by engine ECU (system action) | Remark | HMI behavior (Recommendation) | Engine warning light | Parked regen. if DTC occurred | Behavior during malfunction | Recovery from error | Delay time for recovery |
|--|------------------|----------|-----|------------------------------|--|--|---|---|--|--|-------------------------------|----------------------|-------------------------------|--|--|-------------------------|
| | | SPN | FMI | | | | | | | | | | | | | |
| Pump seizing 2 | P1275 | 523540 | 2 | proprietary | High pressure 2 error | - Sensor supply voltage VCC# is normal - Rail pressure sensor is normal | (Approximate parameter) Rail pressure of more than 267 MPa (2723 kg/cm ² , 38700 psi), and less than 300 MPa (3059 kg/cm ² , 43500 psi) continues total time for 35 seconds [Threshold changes depending on the engine speed. 2600 rpm should be used as a reference] Or, rail pressure of more than 107 MPa (1091 kg/cm ² , 15500 psi) and less than 195 MPa (1988 kg/cm ² , 28300 psi) continues total time for 35 seconds [Threshold changes depending on the engine speed. 200 rpm should be used as a reference] | one time or more | Engine stop | | | ON | Inhibit | - Engine stops | Key switch turn OFF | |
| Accelerator position sensor 1: Low | P2122 | 91 | 4 | Accelerator Pedal Position 1 | Ground short circuit or open circuit of sensor or harness | - Battery voltage is normal - Sensor supply voltage VCC2 is normal | Voltage of accelerator position sensor 1 is 0.3 V or less | transient | Forced idle (Accelerator = 0%) | | | ON | Inhibit | - Insufficient output | Diagnostic counter = zero or Key switch turn OFF | 3 sec |
| Accelerator position sensor 1: High | P2123 | 91 | 3 | Accelerator Pedal Position 1 | +B short circuit of sensor or harness | - Battery voltage is normal - Sensor supply voltage VCC2 is normal | Voltage of accelerator position sensor 1 is 4.8 V or more | transient | Forced idle (Accelerator = 0%) | | | ON | Inhibit | - Insufficient output | Diagnostic counter = zero or Key switch turn OFF | 3 sec |
| Accelerator position sensor 2: Low | P2127 | 29 | 4 | Accelerator Pedal Position 2 | Ground short circuit or open circuit of sensor or harness | - Battery voltage is normal - Sensor supply voltage VCC1 is normal | Voltage of accelerator position sensor 2 is 0.3 V or less | transient | Forced idle (Accelerator = 0%) | | | ON | Inhibit | - Insufficient output | Diagnostic counter = zero or Key switch turn OFF | 3 sec |
| Accelerator position sensor 2: High | P2128 | 29 | 3 | Accelerator Pedal Position 2 | +B short circuit of sensor or harness | - Battery voltage is normal - Sensor supply voltage VCC1 is normal | Voltage of accelerator position sensor 2 is 4.8 V or more | transient | Forced idle (Accelerator = 0%) | | | ON | Inhibit | - Insufficient output | Diagnostic counter = zero or Key switch turn OFF | 3 sec |
| Accelerator position sensor error (CAN) | P2131 | 523543 | 2 | proprietary | Accelerator position sensor signal error (sensor or harness open circuit, ground short circuit etc.) | - Battery voltage is normal - Key switch turn ON - Starter switch signal (ECU: V12 terminal) is not activated | Accelerator position sensor error signal received by CAN | transient | Not applicable | | | ON | Inhibit | - Insufficient output | Diagnostic counter = zero or Key switch turn OFF (CAN signal recovers) | Immediately |
| Injector drive circuit open in No. 1 & 4 cylinder simultaneously | P2146 | 523523 | 2 | proprietary | Wiring harness open circuit | - Engine is operating - Battery voltage is normal - During injection - CPU is normal (VDIC2 is normal) | Wiring harness open circuit | 8 times or more | Output limitation: Approximately 75% of normal condition EGR stop | To minimize PM emission to DPF Injectors which have no error are operated | | ON | Inhibit | - Insufficient output - Engine vibration increases - Worsening exhaust gas emissions - Engine stops in some cases | Key switch turn OFF | |
| No. 1 & 4 cylinder injector short to ground at power supply side, or all cylinder injector short to ground | P2147 | 523523 | 4 | proprietary | Wiring harness short to ground | - Battery voltage is normal - CPU is normal (VDIC2 is normal) - Starter switch signal (ECU: V12 terminal) is not activated | Wiring harness short to ground | 8 times or more | Injectors which have error stop injection Output limitation: Approximately 75% of normal condition EGR stop | To minimize PM emission to DPF Injectors which have no error are operated | | ON | Inhibit | - Insufficient output - Engine vibration increases - Worsening exhaust gas emissions - Engine stops in some cases | Key switch turn OFF | |
| No. 1 & 4 cylinder injector short to +B at power supply side, or all cylinder injector short to +B | P2148 | 523523 | 3 | proprietary | Wiring harness short to +B | - Battery voltage is normal - CPU is normal (VDIC2 is normal) - Starter switch signal (ECU: V12 terminal) is not activated | Wiring harness short to +B | 8 times or more | Injectors which have error stop injection Output limitation: Approximately 75% of normal condition EGR stop | To minimize PM emission to DPF Injectors which have no error are operated | | ON | Inhibit | - Insufficient output - Engine vibration increases - Worsening exhaust gas emissions - Engine stops in some cases | Key switch turn OFF | |
| Injector drive circuit open in No. 2 & 3 cylinder simultaneously | P2149 | 523524 | 2 | proprietary | Wiring harness open circuit | - Engine is operating - Battery voltage is normal - During injection - CPU is normal (VDIC2 is normal) | Wiring harness open circuit | 8 times or more | Output limitation: Approximately 75% of normal condition EGR stop | To minimize PM emission to DPF Injectors which have no error are operated | | ON | Inhibit | - Insufficient output - Engine vibration increases - Worsening exhaust gas emissions - Engine stops in some cases | Key switch turn OFF | |
| No. 2 & 3 cylinder injector short to ground at power supply side, or all cylinder injector short to ground | P2150 | 523524 | 4 | proprietary | Wiring harness short to ground | - Battery voltage is normal - CPU is normal (VDIC2 is normal) - Starter switch signal (ECU: V12 terminal) is not activated | Wiring harness short to ground | 8 times or more | Injectors which have error stop injection Output limitation: Approximately 75% of normal condition EGR stop | To minimize PM emission to DPF Injectors which have no error are operated | | ON | Inhibit | - Insufficient output - Engine vibration increases - Worsening exhaust gas emissions - Engine stops in some cases | Key switch turn OFF | |
| No. 2 & 3 cylinder injector short to +B at power supply side, or all cylinder injector short to +B | P2151 | 523524 | 3 | proprietary | Wiring harness short to +B | - Battery voltage is normal - CPU is normal (VDIC2 is normal) - Starter switch signal (ECU: V12 terminal) is not activated | Wiring harness short to +B | 8 times or more | Injectors which have error stop injection Output limitation: Approximately 75% of normal condition EGR stop | To minimize PM emission to DPF Injectors which have no error are operated | | ON | Inhibit | - Insufficient output - Engine vibration increases - Worsening exhaust gas emissions - Engine stops in some cases | Key switch turn OFF | |
| Barometric pressure sensor error (Low side) | P2228 | 108 | 4 | Barometric Pressure | Sensor or ECU internal circuit short to ground | - Battery voltage is normal | Barometric pressure sensor voltage: 1.6 V or less | 2.8 sec or more | 65 kPa (0.663 kg/cm ² , 9.43 psi) [default value] | Default value is set in consideration with high altitude usage | | ON | Inhibit | - Insufficient output | Diagnostic counter = zero or Key switch OFF | Immediately |

| HMI behavior (Recommendation) | Warning | Caution | Engine stop |
|-------------------------------|---------|---------|-------------|
| | | | |

| DTC | ISO 14229 P-Code | J1939-73 | | SPN name SAE J1939 | Detection item | DTC set preconditions | DTC set parameter | Time to action or number of error detection | Limp home action by engine ECU (system action) | Remark | HMI behavior (Recommendation) | Engine warning light | Parked regen. if DTC occurred | Behavior during malfunction | Recovery from error | Delay time for recovery |
|--|------------------|----------|-----|-------------------------|---|--|---|---|---|--|-------------------------------|----------------------|---|---|---------------------|-------------------------|
| | | SPN | FMI | | | | | | | | | | | | | |
| Barometric pressure sensor error (High side) | P2229 | 108 | 3 | Barometric Pressure | Sensor or ECU internal circuit short to +B | - Battery voltage is normal | Barometric pressure sensor voltage: 4.4 V or more | 2.8 sec or more | 65 kPa (0.663 kg/cm ² , 9.43 psi) [default value] | Default value is set in consideration with high altitude usage | ON | Inhibit | - Insufficient output | Diagnostic counter = zero or Key switch OFF | Immediately | |
| Water in fuel filter failure (Optional) | P3014 | 97 | 31 | Water in Fuel Indicator | Water level in fuel filter | - Battery voltage is normal - Key switch is ON - Starter switch signal is not activated | Sedimenter switch ON | transient | None | | ON | Permit | - Insufficient output - Engine stops | Diagnostic counter = zero or Key switch OFF | | |
| CAN2 Bus off | U0075 | 523547 | 2 | proprietary | CAN2 +B or ground short circuit or high traffic error | - Battery voltage is normal - Key switch is ON | CAN2 bus off | 2 sec or more | Forced idle (Accelerator = 0%) | | ON | Inhibit | - Insufficient output - Transmitted CAN data are invalid | Key switch turn OFF | | |
| CAN1 Bus off | U0077 | 523604 | 2 | proprietary | CAN1 +B or ground short circuit or high traffic error | - Battery voltage is normal - Key switch is ON | CAN1 bus off | 2 sec or more | Output limitation: Approximately 50% of normal condition Speed limitation (Accelerator limitation: 50%) EGR stop | | ON | Inhibit | - Insufficient output - Transmitted CAN data are invalid | Key switch turn OFF | | |
| CAN-Kubota frame error | U0081 | 523548 | 2 | proprietary | CAN-Kubota original frame open circuit error | - Battery voltage is normal - Key switch turn OFF to ON - Starter switch signal (ECU: V12 terminal) is not activated - NO error of "CAN2 Bus off" | CAN2 Kubota frame open circuit error | transient | Forced idle (Accelerator = 0%) | | ON | Inhibit | - Insufficient output | Key switch turn OFF | | |

| HMI behavior (Recommendation) | Warning | Caution | Engine stop |
|-------------------------------|---------|---------|-------------|
| ON | ON | ON | ON |

DTC Code LIST (Aftertreatment related)

| | | | | | | | | | | | | | | | |
|---|-------|--------|---|---|---|--|---|------------------|--|---|----|---------|--|--|-------------|
| Intake air temp. built-in MAF sensor: Low | P0072 | 171 | 4 | Ambient Air Temperature | Ground short circuit of sensor or harness | - Battery voltage is normal | Intake air temp. built-in MAF sensor voltage: 0.1 V or less | 2.8 sec or more | 25 deg. C (77 deg. F) [default value] | | ON | Inhibit | - | Diagnostic counter = zero or Key switch turn OFF | Immediately |
| Intake air temp. built-in MAF sensor: High | P0073 | 171 | 3 | Ambient Air Temperature | Open circuit or +B short circuit of sensor or harness | - Battery voltage is normal | Intake air temp. built-in MAF sensor voltage: 4.9 V or more | 2.8 sec or more | 25 deg. C (77 deg. F) [default value] | | ON | Inhibit | - | Diagnostic counter = zero or Key switch turn OFF | Immediately |
| Intake air volume: Low | P0101 | 132 | 1 | Engine Inlet Air Mass Flow Rate | Engine inlet air mass flow rate lacking (Disconnect turbo blower intake hose) | - Engine is operating 1000 rpm or more - Coolant temp. is 15 deg. C (59 deg. F) or more (Coolant temp. sensor is normal) - MAF sensor is normal - EGR valve is normal - Intake throttle valve is normal - Battery voltage is normal | Engine inlet air mass flow rate: less than half of target value | 10.0 sec or more | Output limitation: Approximately 75% of normal condition EGR stop | | ON | Inhibit | - Insufficient output | Key switch turn OFF | |
| MAF sensor: Low | P0102 | 132 | 4 | Engine Inlet Air Mass Flow Rate | Open circuit or ground short circuit of sensor or harness | - Battery voltage is normal - Starter switch signal (ECU: V12 terminal) is not activated - Sensor supply voltage is normal | Mass air flow sensor voltage: 0.1 V or less | 2.8 sec or more | Sensor output: 0.7 times of target value at normal condition [default value] Output limitation: Approximately 75% of normal condition EGR stop Intake throttle 100% open | Engine is not stopped forcibly by ECU However KUBOTA strongly recommends operator to stop engine as soon as possible | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions | Key switch turn OFF | |
| MAF sensor: High | P0103 | 132 | 3 | Engine Inlet Air Mass Flow Rate | +B short circuit of sensor or harness | - Battery voltage is normal - Engine speed is between 700 rpm and 2800 rpm - Target intake mass air flow is 460 or less and it continues for 3 sec - Sensor supply voltage is normal | Mass air flow sensor voltage: 4.9 V or more at normal operation condition | 2.8 sec or more | Sensor output: 0.7 times of target value at normal condition [default value] Output limitation: Approximately 75% of normal condition EGR stop Intake throttle 100% open | Engine is not stopped forcibly by ECU However KUBOTA strongly recommends operator to stop engine as soon as possible | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions | Key switch turn OFF | |
| Intake air temp.: High Intercooler model only | P0111 | 172 | 0 | Air Inlet Temperature | Intake air temp. too high | - Battery voltage is normal - Key switch is ON | Intake air temp. more than ambient temp. +60 deg. C | 10 sec or more | Output limitation: Approximately 75% of normal condition | Intercooler model only | ON | Inhibit | - | Key switch turn OFF | |
| EGR actuator open circuit | P0403 | 523574 | 3 | proprietary | EGR actuator open circuit | - Battery voltage is normal - NO DTC of U0077 "CAN1 Bus off" - EGR control line is normal | EGR actuator open error signal received via CAN | 2.8 sec or more | Output limitation: Approximately 75% of normal condition EGR stop | | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions | Key switch turn OFF | |
| EGR actuator coil short | P0404 | 523574 | 4 | proprietary | EGR actuator coil short | - Battery voltage is normal - NO DTC of U0077 "CAN1 Bus off" - EGR control line is normal | EGR actuator coil short error signal received via CAN | 2.8 sec or more | Output limitation: Approximately 75% of normal condition EGR stop | | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions | Key switch turn OFF | |
| EGR position sensor failure | P0409 | 523572 | 4 | proprietary | EGR position sensor failure | - Battery voltage is normal - NO DTC of U0077 "CAN1 Bus off" - EGR control line is normal | EGR position sensor error signal received via CAN | 2.8 sec or more | Output limitation: Approximately 75% of normal condition EGR stop | | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions | Key switch turn OFF | |
| Exhaust gas temperature sensor 1: Low | P0543 | 3242 | 4 | Aftertreatment 1 Diesel Particulate Filter Intake Gas Temperature | Ground short circuit of sensor or harness | - Battery voltage is normal | DPF inlet temp. sensor (T1) voltage: 0.08 V or less | 5 sec or more | 0 deg. C (32 deg. F) [default value] Output limitation: Approximately 75% of normal condition | | ON | Inhibit | - | Key switch turn OFF | |

| DTC | ISO 14229 P-Code | J1939-73 | | SPN name SAE J1939 | Detection item | DTC set preconditions | DTC set parameter | Time to action or number of error detection | Limp home action by engine ECU (system action) | Remark | HMI behavior (Recommendation) | Engine warning light | Parked regen. if DTC occurred | Behavior during malfunction | Recovery from error | Delay time for recovery |
|---|------------------|----------|-----|---|---|---|--|---|---|--------|-------------------------------|----------------------|--|---|---------------------|-------------------------|
| | | SPN | FMI | | | | | | | | | | | | | |
| Exhaust gas temperature sensor 1: High | P0544 | 3242 | 3 | Aftertreatment 1 Diesel Particulate Filter Intake Gas Temperature | Open circuit or +B short circuit of sensor or harness | - Battery voltage is normal - Coolant temp. is 65 deg. C (149 deg. F) or more continues longer than 10 min after engine starting - T0 is between 100 deg. C (212 deg. F) and 800 deg. C (1472 deg. F): continues longer than 10 sec or - T2 is between 100 deg. C (212 deg. F) and 800 deg. C (1472 deg. F): continues longer than 10 sec | DPF inlet temp. sensor (T1) voltage: 4.92 V or more | 120 sec or more | 0 deg. C (32 deg. F) [default value] Output limitation: Approximately 75% of normal condition | | ON | Inhibit | - | Key switch turn OFF | | |
| Exhaust gas temperature sensor 0: Low | P0546 | 4765 | 4 | Aftertreatment 1 Diesel Oxidation Catalyst Intake Gas Temperature | Ground short circuit of sensor or harness | - Battery voltage is normal | DOC inlet temp. sensor (T0) voltage: 0.08 V or less | 5 sec or more | 0 deg. C (32 deg. F) [default value] Output limitation: Approximately 75% of normal condition | | ON | Inhibit | - | Key switch turn OFF | | |
| Exhaust gas temperature sensor 0: High | P0547 | 4765 | 3 | Aftertreatment 1 Diesel Oxidation Catalyst Intake Gas Temperature | Open circuit or +B short circuit of sensor or harness | - Battery voltage is normal - Coolant temp. is 65 deg. C (149 deg. F) or more continues longer than 5 min after engine starting - T1 is between 100 deg. C (212 deg. F) and 800 deg. C (1472 deg. F): continues longer than 10 sec or - T2 is between 100 deg. C (212 deg. F) and 800 deg. C (1472 deg. F): continues longer than 10 sec | DOC inlet temp. sensor (T0) voltage: 4.92 V or more | 120 sec or more | 0 deg. C (32 deg. F) [default value] Output limitation: Approximately 75% of normal condition | | ON | Inhibit | - | Key switch turn OFF | | |
| EEPROM check sum error | P1990 | 523700 | 13 | proprietary | Kubota-EEPROM check sum error | - Battery voltage is normal | EEPROM check sum error | transient | None | | ON | Inhibit | - | Key switch turn OFF | | |
| Intake throttle feedback error | P2108 | 523580 | 2 | proprietary | Intake throttle feedback error | - Battery voltage is normal | (Approximate parameter) Deviation of throttle position is not corrected in 20 times of duty error recovery action | 5 sec or more | Output limitation: Approximately 75% of normal condition Intake throttle 100% open | | ON | Inhibit | - | Key switch turn OFF | | |
| Accelerator position sensor correlation error | P2135 | 91 | 2 | Accelerator Pedal Sensor 1 | Deviation from designed correlation in two sensors | - Battery voltage is normal - Accelerator position sensor 1 is normal - Accelerator position sensor 2 is normal | Deviation from designed correlation in two sensors | transient | Forced idle (Accelerator = 0%) | | ON | Inhibit | - Insufficient output | Diagnostic counter = zero or Key switch turn OFF | 3 sec | |
| EGR actuator valve stuck | P2413 | 523575 | 7 | proprietary | EGR actuator valve stuck | - Battery voltage is normal - NO DTC of U0077 "CAN1 Bus off" - EGR control line is normal | EGR actuator valve stuck error signal received via CAN | 2.8 sec or more | Output limitation: Approximately 75% of normal condition EGR stop | | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions | Key switch turn OFF | | |
| EGR (DC motor) overheat | P2414 | 523576 | 2 | proprietary | EGR (DC motor) overheat | - Battery voltage is normal - NO DTC of U0077 "CAN1 Bus off" - EGR control line is normal | EGR (DC motor) temp. error signal (thermistor: 125 deg. C or more) received via CAN | 2.8 sec or more | Output limitation: Approximately 75% of normal condition EGR stop | | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions | Key switch turn OFF | | |
| EGR (DC motor) temp. sensor failure | P2415 | 523577 | 2 | proprietary | EGR (DC motor) temp. sensor failure | - Battery voltage is normal - NO DTC of U0077 "CAN1 Bus off" - EGR control line is normal | EGR (DC motor) temp. sensor error signal received via CAN | 2.8 sec or more | Output limitation: Approximately 75% of normal condition EGR stop | | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions | Key switch turn OFF | | |
| Exhaust gas temperature sensor 2: Low | P242C | 3246 | 4 | Aftertreatment 1 Diesel Particulate Filter Outlet Gas Temperature | Ground short circuit of sensor or harness | - Battery voltage is normal | DPF outlet temp. sensor (T2) voltage: 0.08 V or less | 5 sec or more | 0 deg. C (32 deg. F) [default value] Output limitation: Approximately 75% of normal condition | | ON | Inhibit | - | Key switch turn OFF | | |
| Exhaust gas temperature sensor 2: High | P242D | 3246 | 3 | Aftertreatment 1 Diesel Particulate Filter Outlet Gas Temperature | Open circuit or +B short circuit of sensor or harness | - Battery voltage is normal - Coolant temp. is 65 deg. C (149 deg. F) or more: continues longer than 10 min after engine starting - T0 is between 100 deg. C (212 deg. F) and 800 deg. C (1472 deg. F): continues longer than 10 sec or - T1 is between 100 deg. C (212 deg. F) and 800 deg. C (1472 deg. F): continues longer than 10 sec | DPF outlet temp. sensor (T2) voltage: 4.92 V or more | 120 sec or more | 0 deg. C (32 deg. F) [default value] Output limitation: Approximately 75% of normal condition | | ON | Inhibit | - | Key switch turn OFF | | |
| Differential pressure sensor 1: Low | P2454 | 3251 | 4 | Aftertreatment 1 Diesel Particulate Filter Differential Pressure | Ground short circuit of sensor or harness | - Battery voltage is normal - Sensor supply voltage VCC# is normal - Starter switch signal (ECU: V12 terminal) is not activated | DPF differential pressure sensor voltage: 0.21 V or less | 2.8 sec or more | 0 kPa (0.0 kg/cm2, 0.0 psi) [default value] Output limitation: Approximately 75% of normal condition | | ON | Inhibit | - | Key switch turn OFF | | |
| Differential pressure sensor 1: High | P2455 | 3251 | 3 | Aftertreatment 1 Diesel Particulate Filter Differential Pressure | Open circuit or +B short circuit of sensor or harness | - Battery voltage is normal - Sensor supply voltage VCC# is normal - Starter switch signal (ECU: V12 terminal) is not activated | DPF differential pressure sensor voltage: 4.7 V or more | 2.8 sec or more | 0 kPa (0.0 kg/cm2, 0.0 psi) [default value] Output limitation: Approximately 75% of normal condition | | ON | Inhibit | - | Key switch turn OFF | | |
| Intake throttle lift sensor: Low | P2621 | 523582 | 4 | proprietary | Intake throttle lift sensor: Low | - Battery voltage is normal - Sensor supply voltage VCC# is normal | Intake throttle lift sensor voltage: 0.1 V or less | 2.8 sec or more | Output limitation: Approximately 75% of normal condition Intake throttle 100% open | | ON | Inhibit | - | Key switch turn OFF | | |

| HMI behavior (Recommendation) | Warning | Caution | Engine stop |
|-------------------------------|---------|---------|-------------|
| | | | |

| DTC | ISO 14229 P-Code | J1939-73 | | SPN name SAE J1939 | Detection item | DTC set preconditions | DTC set parameter | Time to action or number of error detection | Limp home action by engine ECU (system action) | Remark | HMI behavior (Recommendation) | Engine warning light | Parked regen. if DTC occurred | Behavior during malfunction | Recovery from error | Delay time for recovery |
|--|------------------|----------|-----|--|--|--|--|---|---|--|-------------------------------|----------------------|--|--|---------------------|-------------------------|
| | | SPN | FMI | | | | | | | | | | | | | |
| Intake throttle lift sensor: High | P2622 | 523582 | 3 | proprietary | Intake throttle lift sensor: High | - Battery voltage is normal - Sensor supply voltage VCC# is normal | Intake throttle lift sensor voltage: 4.89 V or more | 2.8 sec or more | Output limitation: Approximately 75% of normal condition Intake throttle 100% open | | ON | Inhibit | - | Key switch turn OFF | | |
| Emission deterioration | P3001 | 3252 | 0 | Aftertreatment 1 Exhaust Gas Temperature 2 Preliminary FMI | DOC is heated up due to unburned fuel | - Other than during regeneration mode - Coolant temp. is 65 deg. C (149 deg. F) or more continues longer than 5min after engine starting | T1 - T0 is 250 deg. C (482 deg. F) or more | 60 sec or more | Output limitation: Approximately 50% of normal condition Speed limitation (Accelerator limitation: 50%) EGR stop Intake throttle 100% open | To minimize PM emission to DPF | ON | Inhibit | - Insufficient output | Key switch turn OFF | | |
| Emergency Exhaust gas temperature sensor 0: High | P3002 | 4765 | 0 | Aftertreatment 1 Exhaust Gas Temperature 1 Preliminary FMI | DOC inlet temp. (T0): High | - Exhaust gas temp. sensor T0, T1 and T2 are normal - Battery voltage is normal | DOC inlet temp. (T0): 700 deg. C (1292 deg. F) or more | 2.0 sec or more | Stop injection (Q = 0 mm3/st) Engine stop Inhibit starter relay activation until exhaust temp. reduces down to 300 deg. C (572 deg. F) | In case engine ECU is not involved to drive starter, starter activation should be inhibited by other way until exhaust temp. reduces down to 300 deg. C (572 deg. F) | ON | Inhibit | - Engine stops - Inhibited cranking until down to 300 deg. C (572 deg. F) | Under 300 deg. C (572 deg. F) and Key switch turn OFF | | |
| Emergency Exhaust gas temperature sensor 1: High | P3003 | 3242 | 0 | Aftertreatment 1 Exhaust Gas Temperature 2 Preliminary FMI | DPF inlet temp. (T1): High | - Exhaust gas temp. sensor T0, T1 and T2 are normal - Battery voltage is normal | DPF inlet temp. (T1): 715 deg. C (1319 deg. F) or more | 9.0 min or more | Stop injection (Q = 0 mm3/st) Engine stop Inhibit starter relay activation until exhaust temp. reduces down to 300 deg. C (572 deg. F) | In case engine ECU is not involved to drive starter, starter activation should be inhibited by other way until exhaust temp. reduces down to 300 deg. C (572 deg. F) | ON | Inhibit | - Engine stops - Inhibited cranking until down to 300 deg. C (572 deg. F) | Under 300 deg. C (572 deg. F) and Key switch turn OFF | | |
| Emergency Exhaust gas temperature sensor 2: High | P3004 | 3246 | 0 | Aftertreatment 1 Exhaust Gas Temperature 3 Preliminary FMI | DPF outlet temp. (T2): High | - Exhaust gas temp. sensor T0, T1 and T2 are normal - Battery voltage is normal | DPF outlet temp. (T2): 820 deg. C (1508 deg. F) or more | 2.0 sec or more | Stop injection (Q = 0 mm3/st) Engine stop EGR stop Intake throttle 0% open (Close) Inhibit starter relay activation until exhaust temp. reduces down to 300 deg. C (572 deg. F) | In case engine ECU is not involved to drive starter, starter activation should be inhibited by other way until exhaust temp. reduces down to 300 deg. C (572 deg. F) | ON | Inhibit | - Engine stops - Inhibited cranking until down to 300 deg. C (572 deg. F) | Under 300 deg. C (572 deg. F) and Key switch turn OFF | | |
| Excessive PM3 | P3006 | 3701 | 15 | Diesel Particulate Filter Status | PM accumulation level 3 | - Battery voltage is normal | PM accumulation more than trigger level Regeneration level = 3 | transient | Output limitation: Approximately 50% of normal condition | To minimize PM emission | ON | Permit | - Insufficient output | Diagnostic counter = zero or Key switch turn OFF | Immediately | |
| Excessive PM4 | P3007 | 3701 | 16 | Diesel Particulate Filter Status | PM accumulation level 4 | - Battery voltage is normal | PM accumulation more than trigger level Regeneration level = 4 | transient | Output limitation: Approximately 50% of normal condition | To minimize PM emission | ON | Permit | - Insufficient output | Diagnostic counter = zero or Key switch turn OFF | Immediately | |
| Excessive PM5 | P3008 | 3701 | 0 | Diesel Particulate Filter Status | PM accumulation level 5 | - Battery voltage is normal | PM accumulation more than trigger level Regeneration level = 5 | transient | Output limitation: Approximately 50% of normal condition | To minimize PM emission Engine is not stopped forcibly by ECU However KUBOTA strongly recommends operator to stop engine as soon as possible | ON | Inhibit | - Insufficient output | Key switch turn OFF (Reset by Service tool) | | |
| Boost pressure: Low | P3011 | 132 | 15 | Engine Inlet Air Mass Flow Rate | Disconnect the hose between the turbo blower out and intake flange | - Other than during regeneration mode - Engine speed is 1600 rpm or more - Target intake air flow value is 950 mg/cyl or more - MAF sensor is normal - EGR valve is normal - Intake throttle valve is normal - Boost pressure sensor is normal - Barometric pressure sensor is normal - Coolant temp. sensor is normal | Boost pressure sensor output is less than target level in high air flow operating condition | 10 sec or more | Output limitation: Approximately 50% of normal condition Speed limitation (Accelerator limitation: 50%) EGR stop | Engine power is restricted by boost pressure signal accordingly To minimize PM emission to DPF | ON | Inhibit | - Insufficient output | Key switch turn OFF | | |
| Low coolant temp. in parked regeneration | P3012 | 523589 | 17 | proprietary | During regeneration mode, Engine warm-up condition is not satisfied (coolant temp. is low) | - During parked active regeneration mode | Engine coolant temp. stays less than 65 deg. C (149 deg. F) for 1500 seconds or more under parked regeneration process | transient | None | | ON | Inhibit | - | Diagnostic counter = zero or Key switch turn OFF (Leaving from parked active regeneration status) | Immediately | |
| Parked regeneration time out | P3013 | 523590 | 16 | proprietary | Time out error: regeneration incomplete due to low temperature of DPF | - During parked active regeneration mode - Coolant temp. is 65 deg. C (149 deg. F) or more | Regeneration process is not completed within 2700 sec | transient | None | | ON | Inhibit | - | Diagnostic counter = zero or Key switch turn OFF (Leaving from parked active regeneration status) | Immediately | |
| All exhaust temp. sensor failure | P3018 | 523599 | 0 | proprietary | All exhaust temp. sensor failure simultaneously | - Engine speed is 1400 rpm or more - Quantity of injection is 30 mm3/st or more - Coolant temp. is 65 deg. C (149 deg. F) or more: continues longer than 300 sec - Intake air temp. is 0 deg. C (32 deg. F) or more - Passed 100 sec after cranking | All exhaust temp. sensor failure (sensor low) simultaneously | 100 sec or more | Output limitation: Approximately 75% of normal condition | | ON | Inhibit | - | Diagnostic counter = zero or Key switch turn OFF | Immediately | |

| HMI behavior (Recommendation) | Warning | Caution | Engine stop |
|-------------------------------|---------|---------|-------------|
| | | | |

| DTC | ISO 14229 P-Code | J1939-73 | | SPN name SAE J1939 | Detection item | DTC set preconditions | DTC set parameter | Time to action or number of error detection | Limp home action by engine ECU (system action) | Remark | HMI behavior (Recommendation) | Engine warning light | Parked regen. if DTC occurred | Behavior during malfunction | Recovery from error | Delay time for recovery |
|--|------------------|----------|-----|--|--|--|---|---|--|--------|-------------------------------|----------------------|--|--|---------------------|-------------------------|
| | | SPN | FMI | | | | | | | | | | | | | |
| Initial pump-calibration incomplete | P3019 | 523600 | 0 | proprietary | Pump-calibration history | - Battery voltage is normal | Initial pump calibration flag = "0" | transient | None | | ON | Inhibit | - | Diagnostic counter = zero or Key switch turn OFF | Immediately | |
| High exhaust gas temp. after emergency high temp. DTC | P3023 | 523601 | 0 | proprietary | Exhaust gas temperature sensor 0, 1, 2 output | - Battery voltage is normal | All exhaust temp. (T0, T1, T2) reduce to 300 deg. C (572 deg. F) | transient | Engine stop Inhibit starter relay activation until all exhaust temp. (T0, T1, T2) reduces down to 300 deg. C (572 deg. F) | | ON | Inhibit | - | Diagnostic counter = zero or Key switch turn OFF | Immediately | |
| High frequency of regeneration | P3024 | 523602 | 0 | proprietary | Time interval from the end time to the start time of the regeneration | - Battery voltage is normal - Key switch is ON | Regeneration time interval within 30 min occurs three times continuously | transient | Output limitation: Approximately 50% of normal condition EGR stop | | ON | Permit | - Worsening exhaust gas emissions (NOx) | Key switch turn OFF (Reset by Service tool) | | |
| Overheat pre-caution | P3025 | 523603 | 15 | proprietary | Coolant temp. | - Coolant temp. sensor is normal | Engine coolant temperature is 110 deg. C (230 deg. F) or more | transient | None | | ON | Inhibit | - Worsening exhaust gas emissions (NOx) | Diagnostic counter = zero or Key switch turn OFF | Immediately | |
| No communication with EGR | U0076 | 523578 | 2 | proprietary | No communication with EGR | - Battery voltage is normal - Starter switch signal (ECU: V12 terminal) is not activated | Interruption of CAN | 1.3 sec or more | Output limitation: Approximately 75% of normal condition EGR stop | | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions | Key switch turn OFF | | |
| CAN CCVS (Parking switch and Vehicle speed) frame error | U0082 | 523591 | 2 | proprietary | CAN_CCVS communication stopping | - Battery voltage is normal - Starter switch signal (ECU: V12 terminal) is not activated | CAN CCVS frame time out error | 0.1 sec or more | Parking switch = OFF, Vehicle speed = 0 [default value] | | ON | Inhibit | - | Key switch turn OFF | | |
| CAN CM1 (Regen switch) frame error | U0083 | 523592 | 2 | proprietary | CAN_CM1 communication stopping | - Battery voltage is normal - Starter switch signal (ECU: V12 terminal) is not activated | CAN CM1 frame time out error | 0.1 sec or more | Regeneration inhibit = ON, Parked regeneration switch = OFF [default value] | | ON | Inhibit | - | Key switch turn OFF | | |
| CAN DDC1 (Transmission) frame error | U0084 | 523593 | 2 | proprietary | CAN_DDC1 communication stopping | - Battery voltage is normal - Starter switch signal (ECU: V12 terminal) is not activated | CAN DDC1 frame time out error | 0.1 sec or more | Accelerator non-linear processing flag = 0 [default value] Accelerator non-linear processing invalid | | ON | Inhibit | - | Key switch turn OFF | | |
| CAN ETC2 (Neutral switch) frame error | U0085 | 523594 | 2 | proprietary | CAN_ETC2 communication stopping | - Battery voltage is normal - Starter switch signal (ECU: V12 terminal) is not activated | CAN ETC2 frame time out error | 0.1 sec or more | Neutral switch = OFF [default value] | | ON | Inhibit | - | Key switch turn OFF | | |
| CAN ETC5 (Neutral switch) frame error | U0086 | 523595 | 2 | proprietary | CAN_ETC5 communication stopping | - Battery voltage is normal - Starter switch signal (ECU: V12 terminal) is not activated | CAN ETC5 frame time out error | 0.1 sec or more | Neutral switch = OFF [default value] | | ON | Inhibit | - | Key switch turn OFF | | |
| CAN TSC1 frame error | U0087 | 523596 | 2 | proprietary | CAN_TSC1 communication stopping | - Battery voltage is normal - Starter switch signal (ECU: V12 terminal) is not activated | No request to "TSC1 buffer" continues 3 times after over-ride control request (other than 0x00) | 60 msec or more | Override control mode = Normal mode [default value] | | ON | Inhibit | - | Diagnostic counter = zero or Key switch turn OFF | Immediately | |
| CAN EBC1 frame error | U0089 | 523598 | 2 | proprietary | CAN_EBC1 communication stopping | - Battery voltage is normal - Starter switch signal (ECU: V12 terminal) is not activated | CAN EBC1 frame time out error | 0.5 sec or more | Non shutdown [default value] Output limitation: Approximately 75% of normal condition | | ON | Inhibit | - | Diagnostic counter = zero or Key switch turn OFF | Immediately | |
| PCV driving circuit error | P0089 | 523627 | 8 | proprietary | Open circuit of discharge MOS-IC in ECU | - Battery voltage is normal - During injection - CPU is normal (VDIC2 is normal) | Open circuit of discharge MOS-IC in ECU | 20 times or more | Output limitation: Approximately 50% of normal condition Speed limitation (Accelerator limitation: 50%) EGR stop | | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions - Engine stops in some cases | Key switch turn OFF | | |
| Open circuit of harness or coil in PCV line | P0090 | 523612 | 5 | proprietary | Open circuit of harness Open circuit of PCV coil | - Battery voltage is normal - During PCV driving - CPU is normal (VDIC2 is normal) | Open circuit of harness or Open circuit of PCV coil | 8 times or more | Output limitation: Approximately 50% of normal condition Speed limitation (Accelerator limitation: 50%) EGR stop | | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions - Engine stops | Key switch turn OFF | | |
| PCV or PRV drive line short to ground at power supply side (COM3), or all driver line short to ground simultaneously | P0091 | 523607 | 4 | proprietary | Wiring harness short to ground | - Battery voltage is normal - CPU is normal (VDIC2 is normal) - Starter switch signal (ECU: V12 terminal) is not activated | Wiring harness short to ground | 8 times or more | Output limitation: Approximately 50% of normal condition Speed limitation (Accelerator limitation: 50%) EGR stop | | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions - Engine stops | Key switch turn OFF | | |
| PCV or PRV drive line short to +B at power supply side (COM3), or all driver line short to +B simultaneously | P0092 | 523607 | 3 | proprietary | Wiring harness short to +B | - Battery voltage is normal - CPU is normal (VDIC2 is normal) - Starter switch signal (ECU: V12 terminal) is not activated | Wiring harness short to +B | 8 times or more | Output limitation: Approximately 50% of normal condition Speed limitation (Accelerator limitation: 50%) EGR stop | | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions - Engine stops | Key switch turn OFF | | |
| Rail pressure too low | P0191 | 157 | 1 | Engine Injector Metering Rail 1 Pressure | Rail pressure too low (Negative pressure at the Inlet of supply pump is high and supply pump delivery system error, ex filter clogging, air entrainment) | - Injection Q is 0 mm3/st or more and the difference between current target and previous target value is 50 mm3/st or less - During pump operating normally - During discharge value is high | Differential pressure error (target value - actual value of rail pressure) continues for 5 sec and more | transient | Output limitation: Approximately 50% of normal condition Speed limitation (Accelerator limitation: 50%) EGR stop | | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions - Engine stops | Key switch turn OFF | | |

| HMI behavior (Recommendation) | Warning | Caution | Engine stop |
|-------------------------------|---------|---------|-------------|
| | | | |

| DTC | ISO 14229 P-Code | J1939-73 | | SPN name SAE J1939 | Detection item | DTC set preconditions | DTC set parameter | Time to action or number of error detection | Limp home action by engine ECU (system action) | Remark | HMI behavior (Recommendation) | Engine warning light | Parked regen. if DTC occurred | Behavior during malfunction | Recovery from error | Delay time for recovery |
|--|------------------|----------|-----|--|--|---|---|---|---|-------------------------------|-------------------------------|----------------------|-------------------------------|--|---------------------|-------------------------|
| | | SPN | FMI | | | | | | | | | | | | | |
| C/Rail pressure sensor signal keeping a middle range | P0194 | 157 | 2 | Engine Injector Metering Rail 1 Pressure | C/Rail Pressure Sensor Signal keeping a middle range | - Key switch is ON - Engine speed is 850 rpm or more - Target rail pressure is 32 MPa or more and actual rail pressure is 20 MPa or more - Target injection Q is 25 mm ³ /s or more - Pump calibration is completed diagnosis once every 160 msec | -1st tentative error [Average target pressure - Average actual pressure] is 5 MPa or more and [Max - Min] of sampling actual pressure during 160 msec is within 0.01 V (conversion to voltage) tentative error after 2nd [Max - Min] of sampling actual pressure during 160 msec is within 0.01 V (conversion to voltage) DTC is set after these tentative error continue 3 times | transient | Output limitation: Approximately 50% of normal condition Speed limitation (Accelerator limitation: 50%) EGR stop Engine forcibly stopped 60 sec later | | | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions - Engine running noise increases - White smoke increases at low temperature - Engine stops in some cases | Key switch turn OFF | |
| Heater lamp error | P0381 | 675 | 3 | Engine Glow Plug Lamp | +B short of lamp driving circuit when lamp is ON | - Battery voltage is normal - Starter switch signal (ECU: V12 terminal) is not activated - Heater lamp is ON | +B short circuit | 2 sec or more | None | For driver circuit protection | | ON | Permit | - | Key switch turn OFF | |
| SUB CPU (Monitoring IC) FLASH ROM error | P0605 | 628 | 2 | Program Memory | FLASH ROM of monitoring IC error | - Key switch is ON | Check-sum error | one time or more | Engine stop | | | ON | Inhibit | - Engine stops | Key switch turn OFF | |
| Internal IC (VDIC2) clock error 1 | P062B | 523614 | 2 | proprietary | Internal power control IC clock error 1 | - Battery voltage is normal - CPU is normal - Starter switch signal (ECU: V12 terminal) is not activated | Clock error | one sec or more | Output limitation: Approximately 50% of normal condition Speed limitation (Accelerator limitation: 50%) EGR stop 2, 3 cyl injection stop | | | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions - Engine stops | Key switch turn OFF | |
| Internal IC (VDIC2) clock error 2 | P062B | 523614 | 2 | proprietary | Internal power control IC clock error 2 | - Battery voltage is normal - CPU is normal - Starter switch signal (ECU: V12 terminal) is not activated | Clock error | one sec or more | Output limitation: Approximately 50% of normal condition Speed limitation (Accelerator limitation: 50%) EGR stop 1, 4 cyl injection stop | | | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions - Engine stops | Key switch turn OFF | |
| Internal IC (VDIC2) communication error 1 | P062B | 523614 | 2 | proprietary | Internal power control IC communication error 1 | - Battery voltage is normal - CPU is normal - Starter switch signal (ECU: V12 terminal) is not activated | Communication error | one sec or more | Output limitation: Approximately 75% of normal condition EGR stop 2, 3 cyl injection stop | | | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions - Engine stops | Key switch turn OFF | |
| Internal IC (VDIC2) communication error 2 | P062B | 523614 | 2 | proprietary | Internal power control IC communication error 2 | - Battery voltage is normal - CPU is normal - Starter switch signal (ECU: V12 terminal) is not activated | Communication error | one sec or more | Output limitation: Approximately 75% of normal condition EGR stop 1, 4 cyl injection stop | | | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions - Engine stops | Key switch turn OFF | |
| Overheat lamp error | P0655 | 523624 | 3 | proprietary | +B short of lamp driving circuit when lamp is ON | - Battery voltage is normal - Starter switch signal (ECU: V12 terminal) is not activated - Overheat lamp is ON | +B short circuit | 2 sec or more | None | For driver circuit protection | | ON | Permit | - | Key switch turn OFF | |
| Starter relay driving error | P081B | 677 | 3 | Engine Starter Motor Relay | +B short of relay driving circuit when relay is ON | - Battery voltage is normal - Starter switch signal (ECU: V12 terminal) is not activated - Starter relay is ON | +B short circuit | 2 sec or more | None | For driver circuit protection | | ON | Permit | - | Key switch turn OFF | |
| High pressure delivery system too high | P1A06 | 523608 | 2 | proprietary | High pressure delivery system too high | - Battery voltage is normal - Starter switch signal (ECU: V12 terminal) is not activated - During pump operating normally (Pump calibration is completed) - NE sensing is normal - The difference between the previous and current target pressure is 10 MPa or less - No electric noise in pressure sensing | Excessively operating of PRV error (Actual rail pressure > target rail pressure) occur in specified times | transient | Output limitation: Approximately 50% of normal condition Speed limitation (Accelerator limitation: 50%) EGR stop | | | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions - Engine stops | Key switch turn OFF | |
| Coil short in 1st cylinder injector | P1A07 | 651 | 6 | Engine Injector Cylinder #01 | Injector coil short (over current) | - Battery voltage is normal - During injection - CPU is normal (VDIC2 is normal) | Injector coil short (over current) | 8 times or more | Injectors which have error stop injection Output limitation: Approximately 75% of normal condition EGR stop | | | ON | Inhibit | - Insufficient output - Engine vibration increases - Worsening exhaust gas emissions - Engine stops in some cases | Key switch turn OFF | |

| HMI behavior (Recommendation) | Warning | Caution | Engine stop |
|-------------------------------|---------|---------|-------------|
| | | | |

| DTC | ISO 14229 P-Code | J1939-73 | | SPN name SAE J1939 | Detection item | DTC set preconditions | DTC set parameter | Time to action or number of error detection | Limp home action by engine ECU (system action) | Remark | HMI behavior (Recommendation) | Engine warning light | Parked regen. if DTC occurred | Behavior during malfunction | Recovery from error | Delay time for recovery |
|--|------------------|----------|-----|--|--|---|--|---|--|-------------------------------|-------------------------------|----------------------|--|---|---------------------|-------------------------|
| | | SPN | FMI | | | | | | | | | | | | | |
| Coil short in 3rd cylinder injector | P1A08 | 653 | 6 | Engine Injector Cylinder #03 | Injector coil short (over current) | - Battery voltage is normal - During injection - CPU is normal (VDIC2 is normal) | Injector coil short (over current) | 8 times or more | Injectors which have error stop injection Output limitation: Approximately 75% of normal condition EGR stop | | ON | Inhibit | - Insufficient output - Engine vibration increases - Worsening exhaust gas emissions - Engine stops in some cases | Key switch turn OFF | | |
| Coil short in 4th cylinder injector | P1A09 | 654 | 6 | Engine Injector Cylinder #04 | Injector coil short (over current) | - Battery voltage is normal - During injection - CPU is normal (VDIC2 is normal) | Injector coil short (over current) | 8 times or more | Injectors which have error stop injection Output limitation: Approximately 75% of normal condition EGR stop | | ON | Inhibit | - Insufficient output - Engine vibration increases - Worsening exhaust gas emissions - Engine stops in some cases | Key switch turn OFF | | |
| Coil short in 2nd cylinder injector | P1A0A | 652 | 6 | Engine Injector Cylinder #02 | Injector coil short (over current) | - Battery voltage is normal - During injection - CPU is normal (VDIC2 is normal) | Injector coil short (over current) | 8 times or more | Injectors which have error stop injection Output limitation: Approximately 75% of normal condition EGR stop | | ON | Inhibit | - Insufficient output - Engine vibration increases - Worsening exhaust gas emissions - Engine stops in some cases | Key switch turn OFF | | |
| Coil short in PCV | P1A0B | 523609 | 6 | proprietary | PCV coil short (over current) | - Battery voltage is normal - During PCV driving - CPU is normal (VDIC2 is normal) | PCV coil short (over current) | 8 times or more | Output limitation: Approximately 50% of normal condition Speed limitation (Accelerator limitation: 50%) EGR stop | | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions - Engine stops | Key switch turn OFF | | |
| Coil short in PRV | P1A0C | 523610 | 6 | proprietary | PRV coil short (over current) | - Battery voltage is normal - During PRV driving - CPU is normal (VDIC2 is normal) | PRV coil short (over current) | 8 times or more | Output limitation: Approximately 50% of normal condition Speed limitation (Accelerator limitation: 50%) EGR stop | | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions - Engine stops | Key switch turn OFF | | |
| High pressure pump too high | P1A0D | 523611 | 2 | proprietary | High pressure pump too high | - Battery voltage is normal - Starter switch signal (ECU: V12 terminal) is not activated - Key switch is ON | High pressure error is detected specified times (Trigger pressure value are depending on engine speed) | transient | Engine stop | | ON | Inhibit | - Engine stops | Key switch turn OFF | | |
| Parked regeneration request lamp error | P1A0F | 3697 | 3 | Diesel Particulate Filter Lamp Command | +B short of lamp driving circuit when lamp is ON | - Battery voltage is normal - Starter switch signal (ECU: V12 terminal) is not activated - Parked regeneration request Lamp is ON | +B short circuit | 2 sec or more | None | For driver circuit protection | ON | Permit | - | Key switch turn OFF | | |
| Stop lamp error | P1A10 | 523621 | 3 | proprietary | +B short of lamp driving circuit when lamp is ON | - Battery voltage is normal - Starter switch signal (ECU: V12 terminal) is not activated - Stop lamp is ON | +B short circuit | 2 sec or more | None | For driver circuit protection | ON | Permit | - | Key switch turn OFF | | |
| Low oil pressure lamp error | P1A11 | 523622 | 3 | proprietary | +B short of lamp driving circuit when lamp is ON | - Battery voltage is normal - Starter switch signal (ECU: V12 terminal) is not activated - Low oil pressure lamp is ON | +B short circuit | 2 sec or more | None | For driver circuit protection | ON | Permit | - | Key switch turn OFF | | |
| Engine warning lamp error | P1A12 | 4115 | 3 | DTCx Amber Warning Lamp Support & Status | +B short of lamp driving circuit when lamp is ON | - Battery voltage is normal - Starter switch signal (ECU: V12 terminal) is not activated - Engine warning lamp is ON | +B short circuit | 2 sec or more | None | For driver circuit protection | ON | Permit | - | Key switch turn OFF | | |
| TSC1 priority reception error | P1A13 | 523625 | 2 | proprietary | Highest priority reception from other than ACU | - Battery voltage is normal - Starter switch signal (ECU: V12 terminal) is not activated | After received multiple TSC1 commands, the highest priority received from other than ACU | transient | Output limitation: Approximately 50% of normal condition Speed limitation (Accelerator limitation: 10%) | | ON | Permit | - Insufficient output | Key switch turn OFF | | |
| Regeneration inhibit request reception (Not DTC) | P1A14 | 3702 | 13 | Diesel Particulate Filter Active Regeneration Inhibited Status | Regeneration inhibit request from ACU | - Battery voltage is normal - Starter switch signal (ECU: V12 terminal) is not activated | Regeneration inhibit request from ACU | transient | None (Output limitation by TSC1 command from ACU if necessary) | | ON | Inhibit | - Insufficient output (due to TSC1 from ACU) | Diagnostic counter = zero or Key switch turn OFF | one sec | |
| SUB CPU software version unmatched | P1A16 | 523626 | 2 | proprietary | SUB CPU software version unmatched | - Key switch is ON - Battery voltage is 10 V or more - Starter switch signal (ECU: V12 terminal) is not activated | SUB CPU software version unmatched | transient | Engine stop | | ON | Inhibit | - Engine stops | Key switch turn OFF | | |
| TWV1 driving circuit error | P1A18 | 651 | 8 | Engine Injector Cylinder #01 | Open circuit of discharge MOS-IC in ECU | - Battery voltage is normal - During injection - CPU is normal (VDIC2 is normal) | Open circuit of discharge MOS-IC in ECU | 20 times or more | Output limitation: Approximately 75% of normal condition EGR stop | | ON | Inhibit | - Insufficient output - Engine vibration increases - Worsening exhaust gas emissions | Key switch turn OFF | | |

| HMI behavior (Recommendation) | Warning | Caution | Engine stop |
|-------------------------------|---------|---------|-------------|
| | | | |

| DTC | ISO 14229 P-Code | J1939-73 | | SPN name SAE J1939 | Detection item | DTC set preconditions | DTC set parameter | Time to action or number of error detection | Limp home action by engine ECU (system action) | Remark | HMI behavior (Recommendation) | Engine warning light | Parked regen. if DTC occurred | Behavior during malfunction | Recovery from error | Delay time for recovery |
|---|------------------|----------|-----|------------------------------|---|---|--|---|--|-------------------------------|-------------------------------|----------------------|-------------------------------|--|---------------------|-------------------------|
| | | SPN | FMI | | | | | | | | | | | | | |
| TWV2 driving circuit error | P1A19 | 653 | 8 | Engine Injector Cylinder #03 | Open circuit of discharge MOS-IC in ECU | - Battery voltage is normal - During injection - CPU is normal (VDIC2 is normal) | Open circuit of discharge MOS-IC in ECU | 20 times or more | Output limitation: Approximately 75% of normal condition EGR stop | | | ON | Inhibit | - Insufficient output - Engine vibration increases - Worsening exhaust gas emissions | Key switch turn OFF | |
| TWV3 driving circuit error | P1A1A | 654 | 8 | Engine Injector Cylinder #04 | Open circuit of discharge MOS-IC in ECU | - Battery voltage is normal - During injection - CPU is normal (VDIC2 is normal) | Open circuit of discharge MOS-IC in ECU | 20 times or more | Output limitation: Approximately 75% of normal condition EGR stop | | | ON | Inhibit | - Insufficient output - Engine vibration increases - Worsening exhaust gas emissions | Key switch turn OFF | |
| TWV4 driving circuit error | P1A1B | 652 | 8 | Engine Injector Cylinder #02 | Open circuit of discharge MOS-IC in ECU | - Battery voltage is normal - During injection - CPU is normal (VDIC2 is normal) | Open circuit of discharge MOS-IC in ECU | 20 times or more | Output limitation: Approximately 75% of normal condition EGR stop | | | ON | Inhibit | - Insufficient output - Engine vibration increases - Worsening exhaust gas emissions | Key switch turn OFF | |
| Pressure relief valve error | P2293 | 523606 | 2 | proprietary | Pressure relief valve error | - Battery voltage is normal - Starter switch signal (ECU: V12 terminal) is not activated - During pump operating normally (Pump calibration is completed) - NE sensing is normal - Injection Q is 0 mm3/s or less - Not occur tentative error of pressure - No electric noise in pressure sensing | After pressure relief valve (PRV) driving, excessively more pressure than supposed is detected | transient | Output limitation: Approximately 50% of normal condition Speed limitation (Accelerator limitation: 50%) EGR stop | | | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions - Engine stops | Key switch turn OFF | |
| PRV driving circuit error | P2293 | 523628 | 8 | proprietary | Open circuit of discharge MOS-IC in ECU | - Battery voltage is normal - During injection - CPU is normal (VDIC2 is normal) | Open circuit of discharge MOS-IC in ECU | 20 times or more | Output limitation: Approximately 50% of normal condition Speed limitation (Accelerator limitation: 50%) EGR stop | | | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions - Engine stops in some cases | Key switch turn OFF | |
| Open circuit of harness or coil in PRV line | P2294 | 523613 | 5 | proprietary | Open circuit of harness Open circuit of PRV coil | - Battery voltage is normal - During PRV driving - CPU is normal (VDIC2 is normal) | Open circuit of harness or Open circuit of PRV coil | 8 times or more | Output limitation: Approximately 50% of normal condition Speed limitation (Accelerator limitation: 50%) EGR stop | | | ON | Inhibit | - Insufficient output - Worsening exhaust gas emissions - Engine stops | Key switch turn OFF | |
| Active regeneration lamp error | P260E | 523623 | 3 | proprietary | +B short of lamp driving circuit when lamp is ON | - Battery voltage is normal - Starter switch signal (ECU: V12 terminal) is not activated - Active regeneration lamp is ON | +B short circuit | 2 sec or more | None | For driver circuit protection | | ON | Permit | - | Key switch turn OFF | |
| ECU-ACU CAN communication error | U02A3 | 523620 | 2 | proprietary | ECU-ACU CAN communication error (Line Open) | - Battery voltage is normal - Starter switch signal (ECU: V12 terminal) is not activated | CAN communication frame from ACU time out error | transient | Output limitation: Approximately 50% of normal condition Speed limitation (Accelerator limitation: 10%) EGR stop Intake throttle 100% open | | | ON | Inhibit | - Insufficient output | Key switch turn OFF | |

| HMI behavior (Recommendation) | Warning | Caution | Engine stop |
|-------------------------------|---------|---------|-------------|
| | | | |

V3800-TIE5B, D1803-CR-TE5B, V3307-CR-
ACU - DTC Code List

| Component | DTC | ISO 14229 P-Code | J1939-73 | | P-Code Name ISO14229 | SPN Name SAE J1939 | Detection Item | DTC Set Preconditions | DTC set parameter | Time to action or number of error detection | System Action for Hardware Protection | Inducement or De-rating | Recovery from error | Possible Impact on SCR System | Affect to Emissions | Remarks |
|-----------------------------|--|------------------|----------|-----|---|---|---|--|---|---|--|--|--|---|---------------------|--|
| | | | SPN | FMI | | | | | | | | | | | | |
| DEF Pressure Sensor | DEF Pressure sensor error: Out-of-Range Low | P204C | 4334 | 4 | Reductant Pressure Sensor Circuit Low | Aftertreatment 1 Diesel Exhaust Fluid Doser Absolute Pressure | Ground short or open circuit of sensor or harness | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | Voltage of DEF pump pressure sensor is 0.1 V or less | 30 sec or more | - Stop DEF injection - Stop feedback loop control of DEF pressure - Ignore DEF pressure sensor signal - Invalidate DTC; DEF pressure sensor error: Offset High (SPN 4334, FMI 15) | - Inducement pattern: SCR-system Tampering | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - Correct DEF quantity can not be injected - DEF pressure control cannot meet target due to open-loop control, and the pressure will probably be too high or too low | Yes | |
| | DEF Pressure sensor error: Out-of-Range High | P204D | 4334 | 3 | Reductant Pressure Sensor Circuit High | Aftertreatment 1 Diesel Exhaust Fluid Doser Absolute Pressure | +B short circuit of sensor or harness | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - No DTC invalidation flag | Voltage of DEF pump pressure sensor is 4.7 V or more | 30 sec or more | - Stop DEF injection - Stop feedback loop control of DEF pressure - Ignore DEF pressure sensor signal - Invalidate DTC; DEF pressure sensor error: Offset High (SPN 4334, FMI 15) | - Inducement pattern: SCR-system Tampering | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - Correct DEF quantity can not be injected - DEF pressure control cannot meet target due to open-loop control, and the pressure will probably be too high or too low | Yes | |
| | DEF Pressure sensor error: Offset Low | P204B | 4334 | 17 | Reductant Pressure Sensor Circuit Range/Performance | Aftertreatment 1 Diesel Exhaust Fluid Doser Absolute Pressure | After purge process is completed, verify if the sensor output returns to zero | - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is not activated - Cooling down and Purge processes are completed - No DTC invalidation flag | DEF pressure is lower than the trigger value after purge process is completed (DEF pressure should be around 0 kPa in normal) | 3 ignition cycles or more | No action to protect hardware | - Inducement pattern: SCR-system Tampering | Diagnostic counter = zero | - Correct DEF quantity can not be injected - DEF pressure control cannot meet target due to open-loop control, and the pressure will probably be too high or too low | Yes | |
| | DEF Pressure sensor error: Offset High | P204B | 4334 | 15 | Reductant Pressure Sensor Circuit Range/Performance | Aftertreatment 1 Diesel Exhaust Fluid Doser Absolute Pressure | After purge process is completed, verify if the sensor output returns to zero | - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is not activated - Cooling down and Purge processes are completed - No DTC invalidation flag | DEF pressure is higher than the trigger value after purge process is completed (DEF pressure should be around 0 kPa in normal) | 3 ignition cycles or more | No action to protect hardware | - Inducement pattern: SCR-system Tampering | Diagnostic counter = zero | - Correct DEF quantity can not be injected - DEF pressure control cannot meet target due to open-loop control, and the pressure will probably be too high or too low | Yes | |
| DEF Tank Temperature Sensor | DEF Tank Temperature sensor error | P205B | 3031 | 2 | Reductant Tank Temperature Sensor Circuit Range/Performance | Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Temperature | Invalid temperature data | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - CAN communication is normal between ACU and Tank sensor - DTC; DEF Tank Temperature sensor error: Out-of-Range Low (SPN 3031, FMI 4) is not detected - DTC; DEF Tank Temperature sensor error: Out-of-Range High (SPN 3031, FMI 3) is not detected | DEF Tank temperature sensor data are out of range, or timeout for the data message occurred | 12 sec or more | No action to protect hardware | No action | Diagnostic counter = zero | - Thawing process will fail in cold weather DTC; DEF pump prime error (SPN 5435, FMI 1) will occur | None | - If this DTC occurred, the default value of 27 deg. C is used |
| | DEF Tank Temperature sensor error: Out-of-Range Low | P205C | 3031 | 4 | Reductant Tank Temperature Sensor Circuit Low | Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Temperature | Short circuit of sensing element | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - CAN communication is normal between ACU and Tank sensor | Temperature sensor FMI from DEF Tank via CAN is indicating FMI 4 (Sensor element SHORT) | 2 sec or more | No action to protect hardware | No action | Diagnostic counter = zero | - Thawing process will fail in cold weather DTC; DEF pump prime error (SPN 5435, FMI 1) will occur | None | - If this DTC occurred, the default value of 27 deg. C is used - If coolant valve is not operated when thawing process is necessary, DTC; DEF pump prime error (SPN 5435, FMI 1) will occur |
| | DEF Tank Temperature sensor error: Out-of-Range High | P205D | 3031 | 3 | Reductant Tank Temperature Sensor Circuit High | Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Temperature | Open circuit of sensing element | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - CAN communication is normal between ACU and Tank sensor | Temperature sensor FMI from DEF Tank via CAN is indicating FMI 3 (Sensor element OPEN) | 2 sec or more | No action to protect hardware | No action | Diagnostic counter = zero | - Thawing process will fail in cold weather DTC; DEF pump prime error (SPN 5435, FMI 1) will occur | None | - If this DTC occurred, the default value of 27 deg. C is used - If coolant valve is not operated when thawing process is necessary, DTC; DEF pump prime error (SPN 5435, FMI 1) will occur |
| DEF Tank Level Sensor | DEF Tank Level sensor error | P203E | 1761 | 11 | Reductant Level Sensor "A" Circuit Intermittent/Erratic | Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Level | Open circuit of sensing element | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - CAN communication is normal between ACU and Tank sensor | Level sensor FMI from DEF Tank via CAN is indicating FMI 3 (Level Input OPEN) or FMI 11 (Internal sensor error) or invalid level data is received | 47 sec or more | - Stop DEF injection | - De-rating: Idling speed (Level 2) | Diagnostic counter = zero | - If DEF level is empty or very low in DEF tank, DEF injector cooling down can not be operated, DEF injector overheat may occur | Yes | |
| | DEF Tank Level: Low | P203B | 1761 | 17 | Reductant Level Sensor "A" Circuit Range/Performance | Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Level | DEF Tank Level sensor indicates less than the threshold (15%) | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - CAN communication is normal between ACU and Tank sensor - No DTC invalidation flag | Level sensor output from DEF Tank via CAN is 15% or less | 165 sec or more | No action to protect hardware | No action | Diagnostic counter = zero | - Need refill DEF | None | - If OEM required, this DTC can be inactivated. Consult Kubota sales office |
| | DEF Tank Level: Empty | P203F | 1761 | 18 | Reductant Level Too Low | Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Level | DEF Tank Level sensor indicates less than the threshold (5%) | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - CAN communication is normal between ACU and Tank sensor - No DTC invalidation flag | Level sensor output from DEF Tank via CAN is 5% or less | 165 sec or more | No action to protect hardware | - Inducement pattern: DEF Tank Level | Diagnostic counter = zero | - If DEF in the tank is not enough for DEF circulation and DEF injector cooling, DEF injector overheat may occur | Yes | |
| | DEF Tank Level: Leakage | P204F | 1761 | 1 | Reductant Level Performance | Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Level | DEF Tank Level sensor indicates less than the threshold (0%) | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - CAN communication is normal between ACU and Tank sensor - No DTC invalidation flag | Level sensor output from DEF Tank via CAN is 0% or less | 165 sec or more | - Stop DEF injection | - De-rating: Idling speed (Level 2) - DPF regeneration is inhibited | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - DEF injector overheat may occur | Yes | |
| | SCR Temperature sensor error: Out-of-Range Low | P2044 | 4360 | 4 | Reductant Temperature Sensor Circuit Low | Aftertreatment 1 SCR Catalyst Intake Gas Temperature | Ground short circuit of sensor or harness | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | Voltage of SCR temperature sensor is 0.5 V or less | 3 sec or more | - Set SCR temp. sensor quality flag to FALSE (Enable for NOx sensor dew point logic to substitute other signal) | - Inducement pattern: SCR-system Tampering | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - The error will reduce the accuracy of SCR control model and it will possibly decrease NOx or NH3 reduction efficiency | Yes | - Substitute the upstream (DOC/DPF) exhaust temperature sensor value from engine ECU via CAN |

| Component | DTC | ISO 14229 P-Code | J1939-73 | | P-Code Name ISO14229 | SPN Name SAE J1939 | Detection Item | DTC Set Preconditions | DTC set parameter | Time to action or number of error detection | System Action for Hardware Protection | Inducement or De-rating | Recovery from error | Possible Impact on SCR System | Affect to Emissions | Remarks |
|--|---|------------------|----------|-----|--|---|--|--|---|---|---|--|--|---|---------------------|---|
| | | | SPN | FMI | | | | | | | | | | | | |
| SCR EGT (Exhaust Gas Temperature) Sensor | SCR Temperature sensor error: Out-of-Range High | P2045 | 4360 | 3 | Reductant Temperature Sensor Circuit High | Aftertreatment 1 SCR Catalyst Intake Gas Temperature | Open circuit or +B short circuit of sensor or harness | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | Voltage of SCR temperature sensor is 2.5 V or more | 3 sec or more | - Set SCR temp. sensor quality flag to FALSE (Enable for NOx sensor dew point logic to substitute other signal) | - Inducement pattern: SCR-system Tampering | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - The error will reduce the accuracy of SCR control model and it will possibly decrease NOx or NH3 reduction efficiency | Yes | - Substitute the upstream (DOC/DPF) exhaust temperature sensor value from engine ECU via CAN |
| | SCR Temperature sensor error: Stuck High | P2043 | 4360 | 15 | Reductant Temperature Sensor Circuit Range/Performance | Aftertreatment 1 SCR Catalyst Intake Gas Temperature | SCR temp. sensor value stuck high | - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is activated - Differences among Coolant, Ambient, and DEF Tank temperature are less than trigger value - No DTC invalidation flag | Difference between SCR temperature and the averaged temperature of Coolant, Ambient and DEF tank is more than trigger value. This DTC is enabled when differences between 2 of 3 temperatures are less than trigger value | 50 sec or more | - Set SCR temp. sensor quality flag to FALSE (Enable for NOx sensor dew point logic to substitute other signal) | - Inducement pattern: SCR-system Tampering | Diagnostic counter = zero | - The error will reduce the accuracy of SCR control model and it will possibly decrease NOx or NH3 reduction efficiency | Yes | - This DTC is detected during differences among Coolant, Ambient, and DEF Tank temperature are less than trigger value just after engine starting |
| | SCR Temperature sensor error: Rationality | P2046 | 4360 | 2 | Reductant Temperature Sensor Circuit Intermittent | Aftertreatment 1 SCR Catalyst Intake Gas Temperature | Rationality of SCR temperature sensor | - DPF outlet temperature (T2) is more than trigger value - Standard deviation of DPF outlet temperature (T2) is less than trigger value - No DTC invalidation flag - The amount of exhaust gas accumulation after engine start is more than trigger value | Difference between DPF outlet temperature (T2) and SCR temperature is more than trigger value depends on DPF outlet temperature | 50 sec or more | - Set SCR temp. sensor quality flag to FALSE (Enable for NOx sensor dew point logic to substitute other signal) | - Inducement pattern: SCR-system Tampering | Diagnostic counter = zero | - The error will reduce the accuracy of SCR control model and it will possibly decrease NOx or NH3 reduction efficiency | Yes | |
| CAN Bus | CAN1 Bus off | U0077 | 523604 | 2 | Control Module Communication Bus "E" Off | proprietary | Open circuit of harness (CAN1) | - Battery voltage is continuously normal more than 4 sec - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec | CAN1 bus off is detected by ACU | 2 sec or more | No action to protect hardware | No action | Diagnostic counter = zero | None | None | |
| | CAN2 Bus off | U0075 | 523547 | 2 | Control Module Communication Bus "C" Off | proprietary | Open circuit of harness (CAN2) | - Battery voltage is continuously normal more than 4 sec - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec | CAN2 bus off is detected by ACU | 2 sec or more | - Stop DEF injection | - De-rating: Idling speed (Level 2) - DPF regeneration is inhibited | Diagnostic counter = zero | - SCR system can not operate as ACU can not receive the CAN data from Tank sensor, NOx sensors and engine ECU | Yes | - De-rating of this error is executed by ECU |
| | No communication with Tank sensor | U010E | 523616 | 2 | Lost Communication With Reductant Control Module | proprietary | Open circuit of harness (Tank Sensor) | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | Any CAN messages from the Tank sensor are not received | 2 sec or more | - Stop DEF injection | - De-rating: Idling speed (Level 2) | Diagnostic counter = zero | Refer to all Tank sensor DTCs | Yes | |
| | No communication with Pre-NOx sensor | U029D | 523617 | 2 | Lost Communication With NOx Sensor "A" | proprietary | Open circuit of harness (Pre NOx Sensor) | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | CAN message from the Pre NOx sensor is not received | 2 sec or more | No action to protect hardware | - Inducement pattern: SCR-system Tampering | Diagnostic counter = zero | Refer to all Pre NOx sensor DTCs | Yes | - Substitute the engine-out NOx estimation model |
| | No communication with Post-NOx sensor | U029E | 523618 | 2 | Lost Communication With NOx Sensor "B" | proprietary | Open circuit of harness (Post NOx Sensor) | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | CAN message from the Post NOx sensor is not received | 2 sec or more | No action to protect hardware | - Inducement pattern: SCR-system Tampering | Diagnostic counter = zero | Refer to all Post NOx sensor DTCs | Yes | - If this DTC occurred, the DTC: Low Conversion Efficiency (SPN 4364, FMI 1) is invalidated |
| | No communication with Engine ECU | U0100 | 523619 | 2 | Lost Communication With ECM/PCM "A" | proprietary | Open circuit of harness (engine ECU) | - Battery voltage is continuously normal more than 4 sec - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec | Any CAN messages from the engine ECU are not received | 2 sec or more | - Stop DEF injection | - De-rating: Idling speed (Level 2) - DPF regeneration is inhibited | Diagnostic counter = zero | - SCR system can not operate as ACU can not receive the CAN data from engine ECU (engine speed, load, etc.) | Yes | |
| CAN Received Data | Invalid Engine Speed Data | P0726 | 190 | 2 | Engine Speed Input Circuit Range/Performance | Engine speed | Received invalid engine speed data from engine ECU via CAN | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | Received engine speed data is out of range, or timeout for the data message occurred | 3 sec or more | No action to protect hardware | - Inducement pattern: SCR-system Tampering | Diagnostic counter = zero | - Thawing control, EONM (Engine Out NOx Model), and other control logics are affected | Yes | |
| | Invalid DOC Inlet Temperature (T0) Data | P2080 | 4765 | 2 | Exhaust Gas Temperature Sensor Circuit Range/Performance Bank1 Sensor1 | Aftertreatment 1 Diesel Oxidation Catalyst Intake Gas Temperature | Received invalid DOC inlet temperature data from engine ECU via CAN | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | Received DOC inlet temperature data is out of range, or timeout for the data message occurred | 3 sec or more | No action to protect hardware | - Inducement pattern: SCR-system Tampering | Diagnostic counter = zero | - DOC temperature model is affected | Yes | |
| | Invalid Engine Fuel Rate Data | P1A20 | 183 | 2 | proprietary | Engine Fuel Rate | Received invalid engine fuel rate data from engine ECU via CAN | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | Received engine fuel rate data is out of range, or timeout for the data message occurred | 3 sec or more | No action to protect hardware | - Inducement pattern: SCR-system Tampering | Diagnostic counter = zero | - EONM is affected | Yes | |
| | Invalid Intake MAF data per Cylinder | P1A1E | 523631 | 2 | proprietary | proprietary | Received invalid intake MAF data per cylinder from engine ECU via CAN | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | Received intake MAF data per cylinder is out of range, or timeout for the data message occurred | 3 sec or more | - Stop DEF injection | - Inducement pattern: SCR-system Tampering | Diagnostic counter = zero | - EONM is affected | Yes | - If intake MAF data per cylinder are invalid, the correct DEF injection can not be performed due to the NOx gross weight can not be calculated. Therefore the DEF injection is inhibited |
| DEF Injector | DEF Injector short to ground or open circuit or short to +B | P2047 | 3361 | 5 | Reductant Injector Circuit/Open | Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit | Ground short or +B short or open circuit of harness Ground short or +B short or open circuit of DEF injector coil | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - PWM duty cycle is more than 6% | When the DEF injector is operating, the injector electrical current monitoring voltage is 0.200 V or less, or 1.1 V or more for 40 msec (4 msec sampling) or more | 3 times of injection or more | - Stop DEF injection | - Inducement pattern: SCR-system Tampering | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - If ground short circuit on low side, it will cause over dosing and possibly result in deposit, clogging. Also DEF injector overheat may occur - If ground short circuit on high side, it will cause no DEF injection and NOx can not to be reduced - If +B short circuit, it will cause no DEF injection and NOx can not to be reduced - If open circuit, it will cause no DEF injection and NOx can not to be reduced | Yes | - This DTC is detected when the DEF injector is operating. If this DTC occurred, action for ACU circuit protection is enabled and DEF injector drive turns OFF. After that this DTC can not be detected (need ACU restart to recover the diagnosis) |

| Component | DTC | ISO 14229 P-Code | J1939-73 | | P-Code Name ISO14229 | SPN Name SAE J1939 | Detection Item | DTC Set Preconditions | DTC set parameter | Time to action or number of error detection | System Action for Hardware Protection | Inducement or De-rating | Recovery from error | Possible Impact on SCR System | Affect to Emissions | Remarks |
|------------------------------|---|------------------|----------|-----|--|---|---|---|---|---|---------------------------------------|-------------------------|--|---|---------------------|--|
| | | | SPN | FMI | | | | | | | | | | | | |
| Suction Tube Heater HT1 (S) | Suction Tube Heater short to ground | P20BB | 4354 | 4 | Reductant Heater "A" Control Circuit Low | Aftertreatment 1 Diesel Exhaust Fluid Line Heater 1 Request | Ground short circuit of harness Ground short circuit of suction tube heater coil or delivery tube heater coil or return tube heater coil or DEF pump heater coil Heater relay contact sticking at ON position | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | When the suction tube heater is operating, the suction tube heater terminal monitoring voltage (*) is 0.503 V or less | 150 msec or more | - Stop suction tube heater | No action | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - Thawing process will fail in cold weather DTC; DEF pump prime error (SPN 5435, FMI 1) will occur | None | - Initial diagnosis is executed within 150 msec after ACU power turns ON (Suction tube heater drive is not activated until initial diagnosis completed) - If heater is not operated when thawing process is necessary, DTC; DEF pump prime error (SPN 5435, FMI 1) will occur - When this DTC is occurred, 4 heaters need to be checked due to it can not be judged which heater's ground short failure is occurring - This DTC is detected when the suction tube heater is operating. If any heater related DTC occurred, action for ACU circuit protection is enabled and suction tube heater drive turns OFF. After that this DTC can not be detected (need ACU restart to recover the diagnosis) |
| | Suction Tube Heater short to +B | P20BC | 4354 | 3 | Reductant Heater "A" Control Circuit High | Aftertreatment 1 Diesel Exhaust Fluid Line Heater 1 Request | +B short circuit of harness +B short circuit of suction tube heater coil or delivery tube heater coil or return tube heater coil or DEF pump heater coil | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | When the suction tube heater is not operating, the suction tube heater terminal monitoring voltage (*) is 1.937 V or more | 150 msec or more | - Stop suction tube heater | No action | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - Thawing process will fail in cold weather DTC; DEF pump prime error (SPN 5435, FMI 1) will occur | None | - Initial diagnosis is executed within 150 msec after ACU power turns ON (Suction tube heater drive is not activated until initial diagnosis completed) - If heater is not operated when thawing process is necessary, DTC; DEF pump prime error (SPN 5435, FMI 1) will occur - When this DTC is occurred, 4 heaters need to be checked due to it can not be judged which heater's +B short failure is occurring |
| | Suction Tube Heater open circuit | P20B9 | 4354 | 5 | Reductant Heater "A" Control Circuit/Open | Aftertreatment 1 Diesel Exhaust Fluid Line Heater 1 Request | Open circuit of harness Open circuit of suction tube heater coil Heater relay contact sticking at OFF position | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | When the suction tube heater is not operating, the suction tube heater terminal monitoring voltage (*) is 0.503 V or more and 1.937 V or less | 150 msec or more | - Stop suction tube heater | No action | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - Thawing process will fail in cold weather DTC; DEF pump prime error (SPN 5435, FMI 1) will occur | None | - Initial diagnosis is executed within 150 msec after ACU power turns ON (Suction tube heater drive is not activated until initial diagnosis completed) - If heater is not operated when thawing process is necessary, DTC; DEF pump prime error (SPN 5435, FMI 1) will occur |
| | Suction Tube Heater coil short circuit | P20BA | 4354 | 2 | Reductant Heater "A" Control Circuit Performance | Aftertreatment 1 Diesel Exhaust Fluid Line Heater 1 Request | Short circuit of suction tube heater coil | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - Heater relay is activated | When the suction tube heater is operating, the suction tube heater current monitoring voltage is 0.393 V or more and 3.38 V or less | 150 msec or more | - Stop suction tube heater | No action | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - Thawing process will fail in cold weather DTC; DEF pump prime error (SPN 5435, FMI 1) will occur | None | - Initial diagnosis is executed within 150 msec after ACU power turns ON (Suction tube heater drive is not activated until initial diagnosis completed) - If heater is not operated when thawing process is necessary, DTC; DEF pump prime error (SPN 5435, FMI 1) will occur - This DTC is detected when the suction tube heater is operating. If any heater related DTC occurred, action for ACU circuit protection is enabled and suction tube heater drive turns OFF. After that this DTC can not be detected (need ACU restart to recover the diagnosis) |
| Delivery Tube Heater HT3 (D) | Delivery Tube Heater short to ground | P20C3 | 4356 | 4 | Reductant Heater "C" Control Circuit Low | Aftertreatment 1 Diesel Exhaust Fluid Line Heater 3 Request | Ground short circuit of harness Ground short circuit of suction tube heater coil or delivery tube heater coil or DEF pump heater coil Heater relay contact sticking at ON position | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | When the delivery tube heater is operating, the delivery tube heater terminal monitoring voltage (*) is 0.503 V or less | 150 msec or more | - Stop delivery tube heater | No action | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - Thawing process will fail in cold weather DTC; DEF pump prime error (SPN 5435, FMI 1) will occur | None | - Initial diagnosis is executed within 150 msec after ACU power turns ON (Delivery tube heater drive is not activated until initial diagnosis completed) - If heater is not operated when thawing process is necessary, DTC; DEF pump prime error (SPN 5435, FMI 1) will occur - When this DTC is occurred, 4 heaters need to be checked due to it can not be judged which heater's ground short failure is occurring - This DTC is detected when the delivery tube heater is operating. If any heater related DTC occurred, action for ACU circuit protection is enabled and delivery tube heater drive turns OFF. After that this DTC can not be detected (need ACU restart to recover the diagnosis) |
| | Delivery Tube Heater short to +B | P20C4 | 4356 | 3 | Reductant Heater "C" Control Circuit Low | Aftertreatment 1 Diesel Exhaust Fluid Line Heater 3 Request | +B short circuit of harness +B short circuit of suction tube heater coil or delivery tube heater coil or return tube heater coil or DEF pump heater coil | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | When the delivery tube heater is not operating, the delivery tube heater terminal monitoring voltage (*) is 1.937 V or more | 150 msec or more | - Stop delivery tube heater | No action | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - Thawing process will fail in cold weather DTC; DEF pump prime error (SPN 5435, FMI 1) will occur | None | - Initial diagnosis is executed within 150 msec after ACU power turns ON (Delivery tube heater drive is not activated until initial diagnosis completed) - If heater is not operated when thawing process is necessary, DTC; DEF pump prime error (SPN 5435, FMI 1) will occur - When this DTC is occurred, 4 heaters need to be checked due to it can not be judged which heater's +B short failure is occurring |
| | Delivery Tube Heater open circuit | P20C1 | 4356 | 5 | Reductant Heater "C" Control Circuit Low | Aftertreatment 1 Diesel Exhaust Fluid Line Heater 3 Request | Open circuit of harness Open circuit of delivery tube heater coil Heater relay contact sticking at OFF position | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | When the delivery tube heater is not operating, the delivery tube heater terminal monitoring voltage (*) is 0.503 V or more and 1.937 V or less | 150 msec or more | - Stop delivery tube heater | No action | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - Thawing process will fail in cold weather DTC; DEF pump prime error (SPN 5435, FMI 1) will occur | None | - Initial diagnosis is executed within 150 msec after ACU power turns ON (Delivery tube heater drive is not activated until initial diagnosis completed) - If heater is not operated when thawing process is necessary, DTC; DEF pump prime error (SPN 5435, FMI 1) will occur |
| | Delivery Tube Heater coil short circuit | P20C2 | 4356 | 2 | Reductant Heater "C" Control Circuit Performance | Aftertreatment 1 Diesel Exhaust Fluid Line Heater 3 Request | Short circuit of delivery tube heater coil | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - Heater relay is activated | When the delivery tube heater is operating, the delivery tube heater current monitoring voltage is 1.157 V or more and 3.38 V or less | 150 msec or more | - Stop delivery tube heater | No action | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - Thawing process will fail in cold weather DTC; DEF pump prime error (SPN 5435, FMI 1) will occur | None | - Initial diagnosis is executed within 150 msec after ACU power turns ON (Delivery tube heater drive is not activated until initial diagnosis completed) - If heater is not operated when thawing process is necessary, DTC; DEF pump prime error (SPN 5435, FMI 1) will occur - This DTC is detected when the delivery tube heater is operating. If any heater related DTC occurred, action for ACU circuit protection is enabled and delivery tube heater drive turns OFF. After that this DTC can not be detected (need ACU restart to recover the diagnosis) |

| Component | DTC | ISO 14229 P-Code | J1939-73 | | P-Code Name ISO14229 | SPN Name SAE J1939 | Detection Item | DTC Set Preconditions | DTC set parameter | Time to action or number of error detection | System Action for Hardware Protection | Inducement or De-rating | Recovery from error | Possible Impact on SCR System | Affect to Emissions | Remarks |
|----------------------------|---------------------------------------|------------------|----------|-----|--|---|---|---|--|---|---------------------------------------|-------------------------|--|---|---------------------|--|
| | | | SPN | FMI | | | | | | | | | | | | |
| Return Tube Heater HT4 (R) | Return Tube Heater short to ground | P20C7 | 4357 | 4 | Reductant Heater "D" Control Circuit Low | Aftertreatment 1 Diesel Exhaust Fluid Line Heater 4 Request | Ground short circuit of harness Ground short circuit of suction tube heater coil or delivery tube heater coil or return tube heater coil or DEF pump heater coil Heater relay contact sticking at ON position | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | When the return tube heater is operating, the return tube heater terminal monitoring voltage (*1) is 0.503 V or less | 150 msec or more | - Stop return tube heater | No action | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - Thawing process will fail in cold weather DTC; DEF pump prime error (SPN 5435, FMI 1) will occur | None | - Initial diagnosis is executed within 150 msec after ACU power turns ON (Return tube heater drive is not activated until initial diagnosis completed) - If heater is not operated when thawing process is necessary, DTC; DEF pump prime error (SPN 5435, FMI 1) will occur - When this DTC is occurred, 4 heaters need to be checked due to it can not be judged which heater's ground short failure is occurring - This DTC is detected when the return tube heater is operating. If any heater related DTC occurred, action for ACU circuit protection is enabled and return tube heater drive turns OFF. After that this DTC can not be detected (need ACU restart to recover the diagnosis) |
| | Return Tube Heater short to +B | P20C8 | 4357 | 3 | Reductant Heater "D" Control Circuit High | Aftertreatment 1 Diesel Exhaust Fluid Line Heater 4 Request | +B short circuit of harness +B short circuit of suction tube heater coil or delivery tube heater coil or return tube heater coil or DEF pump heater coil | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | When the return tube heater is not operating, the return tube heater terminal monitoring voltage (*1) is 1.937 V or more | 150 msec or more | - Stop return tube heater | No action | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - Thawing process will fail in cold weather DTC; DEF pump prime error (SPN 5435, FMI 1) will occur | None | - Initial diagnosis is executed within 150 msec after ACU power turns ON (Return tube heater drive is not activated until initial diagnosis completed) - If heater is not operated when thawing process is necessary, DTC; DEF pump prime error (SPN 5435, FMI 1) will occur - When this DTC is occurred, 4 heaters need to be checked due to it can not be judged which heater's +B short failure is occurring |
| | Return Tube Heater open circuit | P20C5 | 4357 | 5 | Reductant Heater "D" Control Circuit/Open | Aftertreatment 1 Diesel Exhaust Fluid Line Heater 4 Request | Open circuit of harness Open circuit of return tube heater coil Heater relay contact sticking at OFF position | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | When the return tube heater is not operating, the return tube heater terminal monitoring voltage (*1) is 0.503 V or more and 1.937 V or less | 150 msec or more | - Stop return tube heater | No action | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - Thawing process will fail in cold weather DTC; DEF pump prime error (SPN 5435, FMI 1) will occur | None | - Initial diagnosis is executed within 150 msec after ACU power turns ON (Return tube heater drive is not activated until initial diagnosis completed) - If heater is not operated when thawing process is necessary, DTC; DEF pump prime error (SPN 5435, FMI 1) will occur |
| | Return Tube Heater coil short circuit | P20C6 | 4357 | 2 | Reductant Heater "D" Control Circuit Performance | Aftertreatment 1 Diesel Exhaust Fluid Line Heater 4 Request | Short circuit of return tube heater coil Heater relay contact sticking at ON position | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - Heater relay is activated | When the return tube heater is operating, the return tube heater current monitoring voltage is 1.572 V or more and 3.38 V or less | 150 msec or more | - Stop return tube heater | No action | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - Thawing process will fail in cold weather DTC; DEF pump prime error (SPN 5435, FMI 1) will occur | None | - Initial diagnosis is executed within 150 msec after ACU power turns ON (Return tube heater drive is not activated until initial diagnosis completed) - If heater is not operated when thawing process is necessary, DTC; DEF pump prime error (SPN 5435, FMI 1) will occur - This DTC is detected when the return tube heater is operating. If any heater related DTC occurred, action for ACU circuit protection is enabled and return tube heater drive turns OFF. After that this DTC can not be detected (need ACU restart to recover the diagnosis) |
| DEF Pump Heater HT2 (E) | DEF Pump Heater short to ground | P20BF | 4355 | 4 | Reductant Heater "B" Control Circuit Low | Aftertreatment 1 Diesel Exhaust Fluid Line Heater 2 Request | Ground short of harness Ground short of suction tube heater coil or delivery tube heater coil or DEF pump heater coil or DEF pump heater coil Heater relay contact sticking at ON position | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | When the DEF pump heater is operating, the DEF pump heater terminal monitoring voltage (*1) is 0.503 V or less | 150 msec or more | - Stop DEF pump heater | No action | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - Thawing process will fail in cold weather DTC; DEF pump prime error (SPN 5435, FMI 1) will occur | None | - Initial diagnosis is executed within 150 msec after ACU power turns ON (DEF pump heater drive is not activated until initial diagnosis completed) - If heater is not operated when thawing process is necessary, DTC; DEF pump prime error (SPN 5435, FMI 1) will occur - When this DTC is occurred, 4 heaters need to be checked due to it can not be judged which heater's ground short failure is occurring - This DTC is detected when the DEF pump heater is operating. If any heater related DTC occurred, action for ACU circuit protection is enabled and DEF pump heater drive turns OFF. After that this DTC can not be detected (need ACU restart to recover the diagnosis) |
| | DEF Pump Heater short to +B | P20C0 | 4355 | 3 | Reductant Heater "B" Control Circuit High | Aftertreatment 1 Diesel Exhaust Fluid Line Heater 2 Request | +B short circuit of harness +B short circuit of suction tube heater coil or delivery tube heater coil or return tube heater coil or DEF pump heater coil | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | When the DEF pump heater is not operating, the DEF pump heater terminal monitoring voltage (*1) is 1.937 V or more | 150 msec or more | - Stop DEF pump heater | No action | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - Thawing process will fail in cold weather DTC; DEF pump prime error (SPN 5435, FMI 1) will occur | None | - Initial diagnosis is executed within 150 msec after ACU power turns ON (DEF pump heater drive is not activated until initial diagnosis completed) - If heater is not operated when thawing process is necessary, DTC; DEF pump prime error (SPN 5435, FMI 1) will occur - When this DTC is occurred, 4 heaters need to be checked due to it can not be judged which heater's +B short failure is occurring |
| | DEF Pump Heater open circuit | P20BD | 4355 | 5 | Reductant Heater "B" Control Circuit/Open | Aftertreatment 1 Diesel Exhaust Fluid Line Heater 2 Request | Open circuit of harness Open circuit of DEF pump heater coil Heater relay contact sticking at OFF position | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | When the DEF pump heater is not operating, the DEF pump heater terminal monitoring voltage (*1) is 0.503 V or more and 1.937 V or less | 150 msec or more | - Stop DEF pump heater | No action | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - Thawing process will fail in cold weather DTC; DEF pump prime error (SPN 5435, FMI 1) will occur | None | - Initial diagnosis is executed within 150 msec after ACU power turns ON (DEF pump heater drive is not activated until initial diagnosis completed) - If heater is not operated when thawing process is necessary, DTC; DEF pump prime error (SPN 5435, FMI 1) will occur |
| | DEF Pump Heater coil short circuit | P20BE | 4355 | 2 | Reductant Heater "B" Control Circuit Performance | Aftertreatment 1 Diesel Exhaust Fluid Line Heater 2 Request | Short circuit of DEF pump heater coil | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - Heater relay is activated | When the DEF pump heater is operating, the DEF pump heater current monitoring voltage is 1.18 V or more and 3.36 V or less | 150 msec or more | - Stop DEF pump heater | No action | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - Thawing process will fail in cold weather DTC; DEF pump prime error (SPN 5435, FMI 1) will occur | None | - Initial diagnosis is executed within 150 msec after ACU power turns ON (DEF pump heater drive is not activated until initial diagnosis completed) - If heater is not operated when thawing process is necessary, DTC; DEF pump prime error (SPN 5435, FMI 1) will occur - This DTC is detected when the DEF pump heater is operating. If any heater related DTC occurred, action for ACU circuit protection is enabled and DEF pump heater drive turns OFF. After that this DTC can not be detected (need ACU restart to recover the diagnosis) |

| Component | DTC | ISO 14229 P-Code | J1939-73 | | P-Code Name ISO14229 | SPN Name SAE J1939 | Detection Item | DTC Set Preconditions | DTC set parameter | Time to action or number of error detection | System Action for Hardware Protection | Inducement or De-rating | Recovery from error | Possible Impact on SCR System | Affect to Emissions | Remarks |
|-------------------------------|---|------------------|----------|-----|--|--|--|--|---|---|--|--|--|--|---------------------|--|
| | | | SPN | FMI | | | | | | | | | | | | |
| Heater (External) Relay | Heater Relay short to ground or open circuit | P21C3 | 4353 | 4 | Reductant Heater Relay Control Circuit Low | Aftertreatment 1 Diesel Exhaust Fluid Doser Heating Mode Request | Ground short or open circuit of harness Ground short or open circuit of heater relay coil | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | When the heater relay is not operating, the low side driver terminal monitoring voltage (*1) is low level | 150 msec or more | - Stop suction tube heater - Stop delivery tube heater - Stop return tube heater - Stop DEF pump heater | No action | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - Thawing process will fail in cold weather DTC; DEF pump prime error (SPN 5435, FMI 1) will occur | None | - Initial diagnosis is executed within 150 msec after ACU power turns ON. After that this DTC is disabled for detection due to the heater relay turns ON (need ACU restart to recover the diagnosis) - If heater is not operated when thawing process is necessary, DTC; DEF pump prime error (SPN 5435, FMI 1) will occur |
| | Heater Relay short to +B | P21C4 | 4353 | 3 | Reductant Heater Relay Control Circuit High | Aftertreatment 1 Diesel Exhaust Fluid Doser Heating Mode Request | +B short circuit of harness +B short circuit of heater relay coil | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | When the heater relay is operating, the low side driver terminal monitoring (*1) voltage is high level | 150 msec or more | - Stop suction tube heater - Stop delivery tube heater - Stop return tube heater - Stop DEF pump heater | No action | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - Thawing process will fail in cold weather DTC; DEF pump prime error (SPN 5435, FMI 1) will occur | None | - Initial diagnosis is executed within 150 msec after ACU power turns ON - If heater is not operated when thawing process is necessary, DTC; DEF pump prime error (SPN 5435, FMI 1) will occur - This DTC is detected when the heater relay is operating. If any heater related DTC occurred, action for ACU circuit protection is enabled and heater relay drive turns OFF. After that this DTC can not be detected (need ACU restart to recover the diagnosis) |
| Coolant Valve for Tank Heater | Coolant Valve for Tank Heater short to ground | P202B | 3363 | 4 | Reductant Tank Heater Control Circuit Low | Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Heater | Ground short circuit of harness Ground short circuit of coolant valve coil | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - Diagnosis has not completed during 160 msec after ACU power ON | When the High-side switch is ON, the coolant valve terminal monitoring voltage (*1) is 0.503 V or less (only just after the ACU power turns ON) | 80 msec or more | - Stop coolant valve | No action | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - Thawing process will fail in cold weather DTC; DEF pump prime error (SPN 5435, FMI 1) will occur | None | - The diagnosis is executed within 160 msec after ACU power turns ON (Coolant valve drive is not activated until initial diagnosis completed) - If this DTC occurred, DTC; DEF Injector short to ground or open circuit or short to +B (SPN 3361, FMI 5) will occur at the same time due to common power source circuit is used between DEF injector and coolant valve |
| | Coolant Valve for Tank Heater open circuit | P202A | 3363 | 5 | Reductant Tank Heater Control Circuit/Open | Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Heater | Open circuit of harness Open circuit of coolant valve heater coil | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - Diagnosis has not completed during 160 msec after ACU power ON | When the High-side switch is ON, the coolant valve terminal monitoring voltage (*1) is 0.503 V or more and 1.937 V or less (only just after the ACU power turns ON) | 80 msec or more | - Stop coolant valve | No action | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - Thawing process will fail in cold weather DTC; DEF pump prime error (SPN 5435, FMI 1) will occur | None | - The diagnosis is executed within 160 msec after ACU power turns ON (Coolant valve drive is not activated until initial diagnosis completed) |
| | Coolant Valve for Tank Heater short to +B | P202C | 3363 | 3 | Reductant Tank Heater Control Circuit High | Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Heater | +B short circuit of harness +B short circuit of coolant valve coil | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - Diagnosis has not completed during 160 msec after ACU power ON | When the High-side switch is OFF, the coolant valve terminal monitoring voltage (*1) is 1.937 V or more (only just after the ACU power turns ON) | 80 msec or more | - Stop coolant valve | No action | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - Thawing process will fail in cold weather DTC; DEF pump prime error (SPN 5435, FMI 1) will occur | None | - Initial diagnosis is executed within 160 msec after ACU power turns ON (Coolant valve drive is not activated until initial diagnosis completed) After that this DTC is disabled for detection due to the coolant valve turns ON (High-side switch turns ON) (need ACU restart to recover the diagnosis) |
| DEF Pump | DEF Pump short to ground or open circuit | P208C | 5435 | 4 | Reductant Pump "A" Control Circuit Low | Aftertreatment 1 Diesel Exhaust Fluid Pump State | Ground short or open circuit of harness Ground short or open circuit of DEF pump motor coil | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - Ten times of diagnosis have not completed - DEF pump motor is not operating | When the High-side phase U switch is ON, "all the terminal monitoring voltages (*1) of three-phase U, V, W are 0.563 V or less" or "Phase U terminal monitoring voltage (*1) is 0.563 V or more and Phase V terminal monitoring voltage (*1) is 0.563 V or less" or "Phase U terminal monitoring voltage (*1) is 0.563 V or more and Phase W terminal monitoring voltage (*1) is 0.563 V or less" | 3 times or more | - Engine torque limit for DEF injector protection (Approximately 80% of normal condition) - Stop suction tube heater - Stop delivery tube heater - Stop return tube heater - Stop DEF pump heater - Stop coolant valve - Stop DEF pump (Torque limit) - Stop DEF injection - Invalidate diagnosis of system frozen | - Inducement pattern: SCR-system Tampering - DPF regeneration is inhibited | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - The DEF pressure cannot be possibly controlled and it will cause too high or too low pressure (In some cases DEF circulation cannot be operated), DEF over-dosing or DEF injector overheat may occur | Yes | - To diagnose the DEF pump failure, diagnostic drive waves are applied 10 times as often as after ACU power turns ON and after DEF pump motor turns OFF. During 10 times diagnosis, if failures are detected 3 times continuously, this DTC is set - After 10 times of diagnosis is completed, and the DEF pump motor starts operating, the diagnostic counter goes zero (clear) - If the DEF pump can not be operated, engine torque needs to be limited to protect DEF injector from overheat - This DTC is detected when the DEF pump motor turns OFF. If this DTC occurred, action for ACU circuit protection is enabled and DEF pump motor drive continues OFF. After that this DTC can not be detected (need ACU restart recover the diagnosis) |
| | DEF Pump short to +B | P208D | 5435 | 3 | Reductant Pump "A" Control Circuit High | Aftertreatment 1 Diesel Exhaust Fluid Pump State | +B short circuit of harness +B short circuit of DEF pump motor coil | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - Ten times of diagnosis have not completed - DEF pump motor is not operating | When all six switches of High side phase U, V, W and Low side phase U, V, W are OFF, all the terminal monitoring voltages (*1) of three-phase U, V, W are 0.563 V or more | 3 times or more | - Engine torque limit for DEF injector protection (Approximately 80% of normal condition) - Stop suction tube heater - Stop delivery tube heater - Stop return tube heater - Stop DEF pump heater - Stop coolant valve - Stop DEF pump (Torque limit) - Stop DEF injection - Invalidate diagnosis of system frozen | - Inducement pattern: SCR-system Tampering - DPF regeneration is inhibited | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - The DEF pressure cannot be possibly controlled and it will cause too high or too low pressure (In some cases DEF circulation cannot be operated), DEF over-dosing or DEF injector overheat may occur | Yes | - To diagnose the DEF pump failure, diagnostic drive waves are applied 10 times as often as after ACU power turns ON and after DEF pump motor turns OFF. During 10 times diagnosis, if failures are detected 3 times continuously, this DTC is set - After 10 times of diagnosis is completed, and the DEF pump motor starts operating, the diagnostic counter goes zero (clear) - If the DEF pump can not be operated, engine torque needs to be limited to protect DEF injector from overheat - This DTC is detected when the DEF pump motor turns OFF. If this DTC occurred, action for ACU circuit protection is enabled and DEF pump motor drive continues OFF. After that this DTC can not be detected (need ACU restart recover the diagnosis) |
| | DEF Pump Motor uncontrollable | P208B | 5435 | 12 | Reductant Pump "A" Control Range/Performance | Aftertreatment 1 Diesel Exhaust Fluid Pump State | Clogging, abrasion, and broken of DEF pump motor | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - Thawing process is completed | "Failure of recovery" state of the DEF pump motor is detected If DEF pump motor cannot be controlled due to motor step out, DEF pump motor state will change as follows: "Steady drive" -> "Recovery control" -> "Failure of recovery" -> "Motor stop" | 3 times or more | - Engine torque limit for DEF injector protection (Approximately 80% of normal condition) - Stop suction tube heater - Stop delivery tube heater - Stop return tube heater - Stop DEF pump heater - Stop coolant valve - Stop DEF pump (Torque limit) - Stop DEF injection - Invalidate diagnosis of system frozen | - Inducement pattern: SCR-system Tampering - DPF regeneration is inhibited | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - The DEF pressure cannot be possibly controlled and it will cause too high or too low pressure (In some cases DEF circulation cannot be operated), DEF over-dosing or DEF injector overheat may occur | Yes | - Thawing process starts if estimated DEF tube temperature or measured DEF tank temperature is less than 0 deg. C - If the DEF pump can not be operated, engine torque needs to be limited to protect DEF injector from overheat - This DTC is detected when the DEF pump motor state goes to "Failure of recovery". If this DTC occurred, action for ACU circuit protection is enabled and DEF pump motor drive continues OFF. After that this DTC can not be detected (need ACU restart recover the diagnosis) |
| | DEF Pump failed to prime (circulate) | P208B | 5435 | 1 | Reductant Pump "A" Control Range/Performance | Aftertreatment 1 Diesel Exhaust Fluid Pump State | DEF priming (circulation) is failed or DEF circulation or DEF pressure is not controlled | - Thawing process is completed - DEF pump final duty is trigger value or more - DEF pump is operating - Before purge process starts - No DTC invalidation flag - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is activated | DEF pump prime status is FALSE DEF flow control system is in uncontrollable (FCS_ERR) state | 1 time or more | - Engine torque limit for DEF injector protection (Approximately 80% of normal condition) - Stop suction tube heater - Stop delivery tube heater - Stop return tube heater - Stop DEF pump heater - Stop coolant valve - Stop DEF pump (Torque limit) - Stop DEF injection - Invalidate diagnosis of system frozen | - Inducement pattern: SCR-system Tampering - DPF regeneration is inhibited | ACU restart | - It will cause too low DEF pressure (In some cases DEF circulation cannot be operated), DEF injector overheat may occur - DEF circulation and DEF injection can not be operated | Yes | - If the DEF pump can not be operated, engine torque needs to be limited to protect DEF injector from overheat Possible cause: - Motor-pump decoupling - Motor harness failure - DEF pressure sensor failure - DEF leakage - DEF clogging |

| Component | DTC | ISO 14229 P-Code | J1939-73 | | P-Code Name ISO14229 | SPN Name SAE J1939 | Detection Item | DTC Set Preconditions | DTC set parameter | Time to action or number of error detection | System Action for Hardware Protection | Inducement or De-rating | Recovery from error | Possible Impact on SCR System | Affect to Emissions | Remarks |
|-------------------------|--|----------------------|----------|------|---|--|---|--|--|--|---------------------------------------|--|--|---|---|--|
| | | | SPN | FMI | | | | | | | | | | | | |
| SCR System | Low Conversion Efficiency | P20EE | 4364 | 1 | SCR NOx Catalyst Efficiency Below Threshold | Aftertreatment 1 SCR Conversion Efficiency | Difference between target reduction efficiency and measured reduction efficiency | - Engine speed, MAF data, exhaust temperature, Pre NOx concentration, estimated reduction efficiency, ambient temperature, atmospheric pressure are within each appropriate range (set value) - Post NOx sensor's sampling and averaging processes are completed - No DTC invalidation flag | The averaged Post NOx sensor output is greater than NOx concentration estimated by NOx reduction efficiency | 300 sec or more | No action to protect hardware | - Inducement pattern: SCR-system Tampering | Diagnostic counter = zero | - No impact on SCR system hardware - It will probably impact on a emissions regulation | Yes | - If catalyst is extracted, this DTC will occur |
| | DEF Consumption High | P20F5 | 4350 | 15 | Reductant Consumption Too High | Aftertreatment 1 Diesel Exhaust Fluid Requested Quantity of Integrator | DEF leakage from DEF pump, DEF tube, DEF injector, DEF tank DEF injector stuck open or partially open | - Refill event is not detected - DEF tank level estimated by accumulation of DEF injection is more than trigger level - No DTC invalidation flag | Measured DEF tank level change is greater than the estimated level change calculated by set value DEF tank level change is estimated by accumulation of DEF injection rate | 10 min or more | No action to protect hardware | - Inducement pattern: SCR-system Tampering | Diagnostic counter = zero | - DEF leakage is suspected | Yes | - DEF leakage is suspected |
| DEF Tank Quality sensor | DEF Tank Quality sensor error | P206A | 3516 | 11 | Reductant Quality Sensor Circuit | Aftertreatment 1 Diesel Exhaust Fluid Concentration | Short or open circuit of sensor | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - CAN communication is normal between ACU and Tank sensor | Quality sensor FMI from DEF Tank via CAN is indicating FMI 3 (Sensor element OPEN), or FMI 4 (Internal sensor error), or invalid concentration data is received | 175 sec or more | - Stop DEF injection | - Inducement pattern: SCR-system Tampering | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - It will probably impact on all of DEF quality related DTC | Yes | |
| | DEF Tank Quality: Low | P206C | 3516 | 18 | Reductant Quality Sensor Circuit Low | Aftertreatment 1 Diesel Exhaust Fluid Concentration | DEF concentration: Low | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - CAN communication is normal between ACU and Tank sensor - DEF Tank Quality sensor operation is normal - DEF temperature is more than trigger value | DEF concentration data from DEF Tank via CAN is less than 25% | 350 sec or more | No action to protect hardware | - Inducement pattern: DEF Quality | Diagnostic counter = zero | - It will possibly decrease NOx reduction efficiency | Yes | |
| | DEF Tank Quality: High | P206D | 3516 | 16 | Reductant Quality Sensor Circuit High | Aftertreatment 1 Diesel Exhaust Fluid Concentration | DEF concentration: High | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - CAN communication is normal between ACU and Tank sensor - DEF Tank Quality sensor operation is normal - DEF temperature is more than trigger value | DEF concentration data from DEF Tank via CAN is more than 40% | 350 sec or more | No action to protect hardware | - Inducement pattern: DEF Quality | Diagnostic counter = zero | - It will possibly cause high NH3 slip | Yes | |
| | DEF Tank Quality: Incorrect sensor reading | P206B | 3516 | 12 | Reductant Quality Sensor Circuit Range/Performance | Aftertreatment 1 Diesel Exhaust Fluid Concentration | Incorrect reading of DEF Quality sensor | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - CAN communication is normal between ACU and Tank sensor | DEF type from DEF Tank sensor via CAN is indicating 13 (Unknown), or 14 (Error) | 175 sec or more | No action to protect hardware | - Inducement pattern: DEF Quality | Diagnostic counter = zero | - It will possibly decrease NOx reduction efficiency - It will possibly cause high NH3 slip | Yes | |
| | Diesel in DEF Tank | P207F | 3516 | 2 | Reductant Quality Performance | Aftertreatment 1 Diesel Exhaust Fluid Concentration | Diesel in DEF tank | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - CAN communication is normal between ACU and Tank sensor | DEF type from DEF Tank sensor via CAN is indicating 2 (Diesel, Oil solution) | 30 sec or more | - Stop DEF injection | - Inducement pattern: DEF Quality | Diagnostic counter = zero | - Catalyst can be damaged | Yes | |
| | Pre-NOx Sensor | Pre-NOx sensor error | P2200 | 3216 | 12 | NOx Sensor Circuit Bank 1 Sensor 1 | Aftertreatment 1 Intake NOx | Abnormal voltage, instability of readings, open circuit, short circuit of NOx sensor | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - CAN communication is normal between ACU and Pre NOx sensor | - NOx sensor CAN message is indicating NOx sensor error (Abnormal voltage, Instability of readings, Open circuit, Short circuit, Invalid NOx data, Invalid O2 data) - In spite of Pre NOx sensor operation is normal, NOx sensor CAN message is indicating NOx value are more than 3012 ppm or O2 value are more than 21% | 3 sec or more | No action to protect hardware | - Inducement pattern: SCR-system Tampering | Diagnostic counter = zero | - The error will reduce the accuracy of SCR control model and it will possibly decrease NOx or NH3 reduction efficiency | Yes |
| Pre-NOx Sensor | Pre-NOx sensor heater error | P220E | 3223 | 12 | NOx Sensor Heater Control Circuit Range/Performance Bank 1 Sensor 1 | Aftertreatment 1 Intake Gas Sensor Heater Control | Short or open circuit of NOx sensor heater | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - CAN communication is normal between ACU and Pre NOx sensor | NOx sensor CAN message is indicating NOx sensor error (Open circuit or Short circuit of NOx sensor heater) | 3 sec or more | No action to protect hardware | - Inducement pattern: SCR-system Tampering | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - The error will reduce the accuracy of SCR control model and it will possibly decrease NOx or NH3 reduction efficiency | Yes | - Substitute the engine-out NOx estimation model |
| Pre-NOx Sensor | Pre-NOx sensor error: Tampering | P1A21 | 3216 | 1 | Proprietary | Aftertreatment 1 Intake NOx | Pre NOx sensor is removed from exhaust pipe and located in the atmosphere | - Engine is operating - Engine load is more than trigger value - Pre NOx sensor operation is normal | A) Maximum NOx concentration value during sampling time is less than threshold B) Minimum O2 concentration value during sampling time is less than threshold C) NOx concentration value range between maximum and minimum is less than threshold D) O2 concentration value range between maximum and minimum is less than threshold | 300 sec or more | No action to protect hardware | - Inducement pattern: SCR-system Tampering | Diagnostic counter = zero | - The error will reduce the accuracy of SCR control model and it will possibly decrease NOx or NH3 reduction efficiency | Yes | |

| Component | DTC | ISO 14229 P-Code | J1939-73 | | P-Code Name ISO14229 | SPN Name SAE J1939 | Detection Item | DTC Set Preconditions | DTC set parameter | Time to action or number of error detection | System Action for Hardware Protection | Inducement or De-rating | Recovery from error | Possible Impact on SCR System | Affect to Emissions | Remarks |
|---|----------------------------------|------------------|----------|-----|---|---|--|---|--|---|--|---|--|--|---------------------|--|
| | | | SPN | FMI | | | | | | | | | | | | |
| Post-NOx Sensor | Post-NOx sensor error | P229E | 3226 | 12 | NOx Sensor Circuit Bank 1 Sensor 2 | Aftertreatment 1 Outlet NOx | Abnormal voltage, instability of readings, open circuit, short circuit of NOx sensor | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - CAN communication is normal between ACU and Post NOx sensor | NOx sensor CAN message is indicating NOx sensor error (Abnormal voltage, Instability of readings, Open circuit, Short circuit, Invalid NOx data, Invalid O2 data) - In spite of Post NOx sensor operation is normal, NOx sensor CAN message is indicating NOx value are more than 3012 ppm or O2 value are more than 21% | 3 sec or more | No action to protect hardware | - Inducement pattern: SCR-system Tampering | Diagnostic counter = zero | - NOx concentration after SCR can not be monitored | Yes | |
| | Post-NOx sensor Heater error | P220F | 3233 | 12 | NOx Sensor Heater Control Circuit Range/Performance Bank 1 Sensor 2 | Aftertreatment 1 Outlet Gas Sensor Heater Control | Short or open circuit of NOx sensor heater | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU - CAN communication is normal between ACU and Post NOx sensor | NOx sensor CAN message is indicating NOx sensor error (Open circuit or Short circuit of NOx sensor heater) | 3 sec or more | No action to protect hardware | - Inducement pattern: SCR-system Tampering | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - NOx concentration after SCR can not be monitored | Yes | |
| | Post-NOx sensor error: Tampering | P1A22 | 3226 | 1 | Proprietary | Aftertreatment 1 Outlet NOx | Post NOx sensor is removed from exhaust pipe and located in the atmosphere | - Engine is operating - Engine load is more than trigger value - Post NOx sensor operation is normal | A) Maximum NOx concentration value during sampling time is less than threshold B) Minimum O2 concentration value during sampling time is less than threshold C) NOx concentration value range between maximum and minimum is less than threshold D) O2 concentration value range between maximum and minimum is less than threshold | 300 sec or more | No action to protect hardware | - Inducement pattern: SCR-system Tampering | Diagnostic counter = zero | - The error will reduce the accuracy of SCR control model and it will possibly decrease NOx or NH3 reduction efficiency | Yes | |
| DEF Dosing Pressure Monitor | DEF Dosing Pressure error: High | P20E9 | 4334 | 16 | Reductant Pressure Too High | Aftertreatment 1 Diesel Exhaust Fluid Doser Absolute Pressure | Clogging (before pressure sensor), Unusual motor condition, Time to replace filter | - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is activated - Purge process is not completed - Thawing process is completed - DEF pump is operating - DEF pressure target is not under changing - DEF pump pressure sensor operation is normal - No DTC invalidation flag | Measured DEF pressure minus Target DEF pressure is more than 100 kPa | 60 sec or more | - Stop DEF injection | - Inducement pattern: SCR-system Tampering - DPF regeneration is inhibited | Restart ACU | - Correct DEF quantity can not be injected - Too high DEF pressure will cause over dosing and possibly result in deposit | Yes | |
| | DEF Dosing Pressure error: Low | P20E8 | 4334 | 18 | Reductant Pressure Too Low | Aftertreatment 1 Diesel Exhaust Fluid Doser Absolute Pressure | Clogging (after pressure sensor), Unusual motor condition, Time to replace filter | - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is activated - Purge process is not completed - Thawing process is completed - DEF pump is operating - DEF pressure target is not under changing - DEF pump pressure sensor operation is normal - No DTC invalidation flag | Target DEF pressure minus Measured DEF pressure is more than 100 kPa | 60 sec or more | - Stop DEF injection | - Inducement pattern: SCR-system Tampering | Restart ACU | - Correct DEF quantity can not be injected - If DEF pressure is too low, DEF circulation cannot be operated. DEF injector overheat may occur | Yes | |
| Sensor 5 V Supply Voltage (From ACU to Sensors) | Sensor supply voltage: Low | P0642 | 3509 | 4 | Sensor Reference Voltage "A" Circuit Low | Sensor supply voltage 1 | Ground short circuit of harness | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | Terminal monitoring voltage (*1) is 2.1875 V or less | 3 sec or more | - Stop DEF pump - Stop suction tube heater - Stop delivery tube heater - Stop return tube heater - Stop DEF pump heater - Stop coolant valve - Stop feedback control of DEF pressure (turn to open loop control) | - De-rating: Idling speed (Level 2) | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - If sensor output is misread, thawing control and dosing control will be affected | Yes | - If the DEF pump can not be operated, engine torque needs to be limited to protect DEF injector from overheat |
| | Sensor supply voltage: High | P0643 | 3509 | 3 | Sensor Reference Voltage "A" Circuit High | Sensor supply voltage 1 | +B short circuit of harness | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | Terminal monitoring voltage (*1) is 2.8125 V or more | 3 sec or more | - Stop DEF pump - Stop suction tube heater - Stop delivery tube heater - Stop return tube heater - Stop DEF pump heater - Stop coolant valve - Stop feedback control of DEF pressure (turn to open loop control) | - De-rating: Idling speed (Level 2) | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - If sensor output is misread, thawing control and dosing control will be affected | Yes | - If the DEF pump can not be operated, engine torque needs to be limited to protect DEF injector from overheat |
| System Power | Battery voltage: Low | P0562 | 168 | 4 | System Voltage Low | Battery Potential / Power Input 1 | Short circuit or damage of harness Failure of battery | - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | Battery voltage is less than 10 V | 1 sec or more | No action to protect hardware | - Inducement pattern: SCR-system Tampering | Diagnostic counter = zero | - Correct DEF quantity can not be injected - If DEF pressure is too low, DEF circulation cannot be operated. DEF injector overheat may occur - Thawing process can not be operated | Yes | |
| | Battery voltage: High | P0563 | 168 | 3 | System Voltage High | Battery Potential / Power Input 1 | Open circuit or damage of harness Failure of battery | - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | Battery voltage is more than 16 V | 5 sec or more | - Stop suction tube heater - Stop delivery tube heater - Stop return tube heater - Stop DEF pump heater - Stop coolant valve | - Inducement pattern: SCR-system Tampering | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - Heaters overheat may occur - Deterioration of DEF quality by overheated heaters | Yes | DEF pump will not be broken at this voltage |
| ACU FLASH ROM | ACU FLASH ROM error | P0605 | 628 | 2 | Internal Control Module Read Only Memory (ROM) Error | Program Memory | Flash ROM error | Just after the ACU power turns ON | Checksum error | 1 time or more | No action to protect hardware | - De-rating: Idling speed (Level 2) | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | - SCR system is not activated | Yes | |

| Component | DTC | ISO 14229 P-Code | J1939-73 | | P-Code Name ISO14229 | SPN Name SAE J1939 | Detection Item | DTC Set Preconditions | DTC set parameter | Time to action or number of error detection | System Action for Hardware Protection | Inducement or De-rating | Recovery from error | Possible Impact on SCR System | Affect to Emissions | Remarks |
|-----------|---|------------------|----------|-----|---|---|----------------------|--|---|---|---------------------------------------|--|--|---|-------------------------|---------|
| | | | SPN | FMI | | | | | | | | | | | | |
| Others | EGR system error | P0404 | 523632 | 2 | EGR "A" Control Circuit Range/Performance | Proprietary | EGR system error | - Battery voltage is normal - IG switch signal (ECU: V13 & V33, ACU: 18 terminal) is continuously activated more than 2 sec - Starter switch signal (ECU: V12 terminal) is not activated except within 2 sec after starter stopped - CAN communication is normal between ACU and engine ECU | EGR system error related DTC is received from engine ECU via CAN | 3 sec or more | No action to protect hardware | - Inducement pattern: SCR-system Tampering | Either 1) or 2) 1) IG switch turn OFF and Diagnostic counter = zero 2) ACU restart | None | Yes | |
| | DEF Injector QR Data Fault: No QR Data | P1A23 | 3361 | 7 | Proprietary | Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit | QR data is unwritten | - Battery voltage is normal | The stored QR data in ACU memory is vacant [0x000000000] | 3 sec or more | No action to protect hardware | No action | Diagnostic counter = zero | - It will possibly decrease NOx reduction efficiency depends on calibration value | Yes, but not big impact | |
| | DEF Injector QR Data Fault: Invalid QR Data | P1A24 | 3361 | 2 | Proprietary | Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit | QR data read error | - Battery voltage is normal | Checksum error for QR data are occurred QR data are not the ascii code '0' - '9' DEF injector slope data are out of calibration range | 3 sec or more | No action to protect hardware | No action | Diagnostic counter = zero | - It will possibly decrease NOx reduction efficiency depends on calibration value | Yes, but not big impact | |

(*1) "Monitoring voltage" above mentioned is not a voltage at the ECU terminal but a voltage at inside microprocessor terminal

Note: If DEF can not be injected, the inducement is required for emission regulation