

SECTION 5 MECHATRONICS SYSTEM

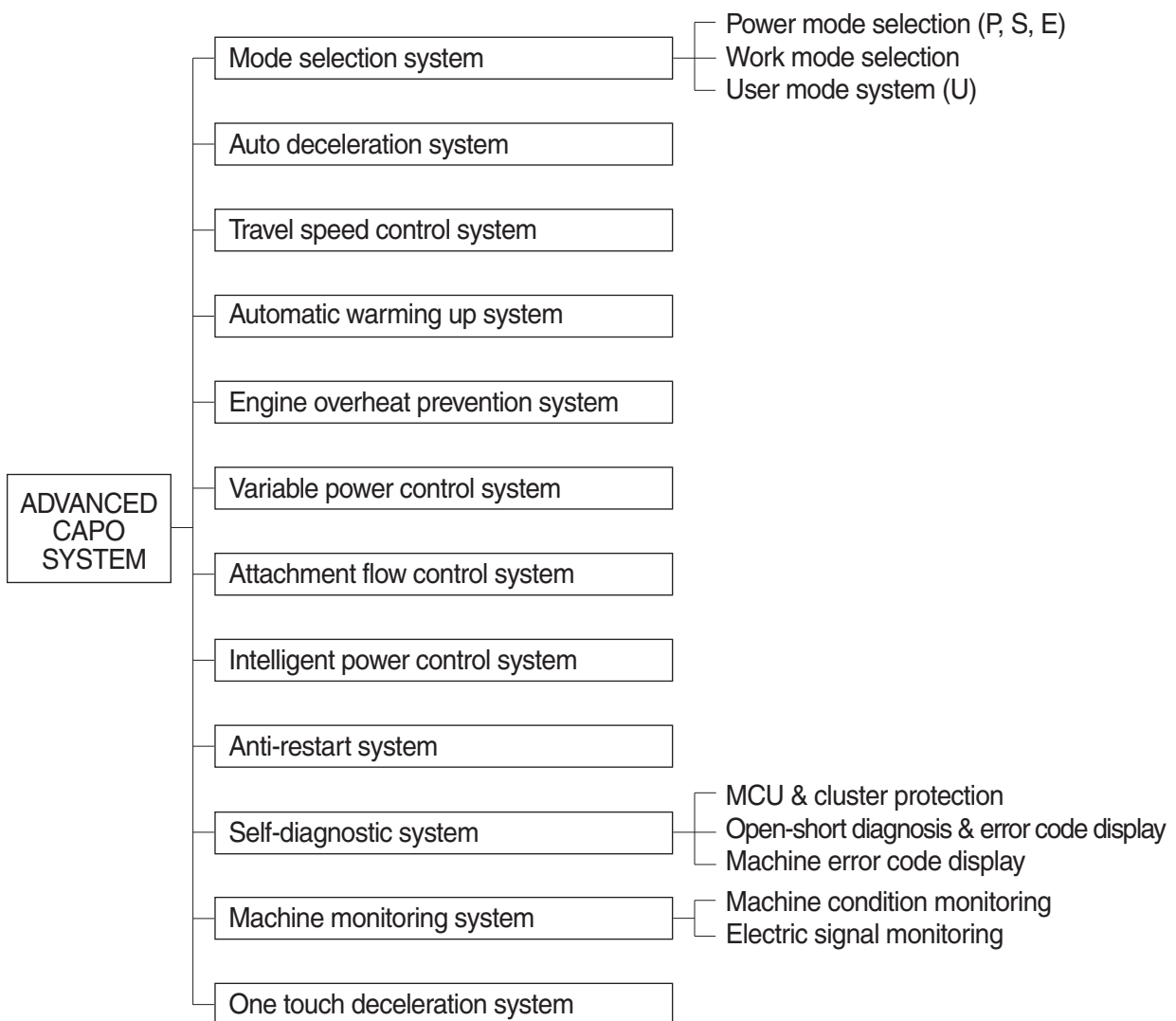
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SECTION 5 MECHATRONICS SYSTEM

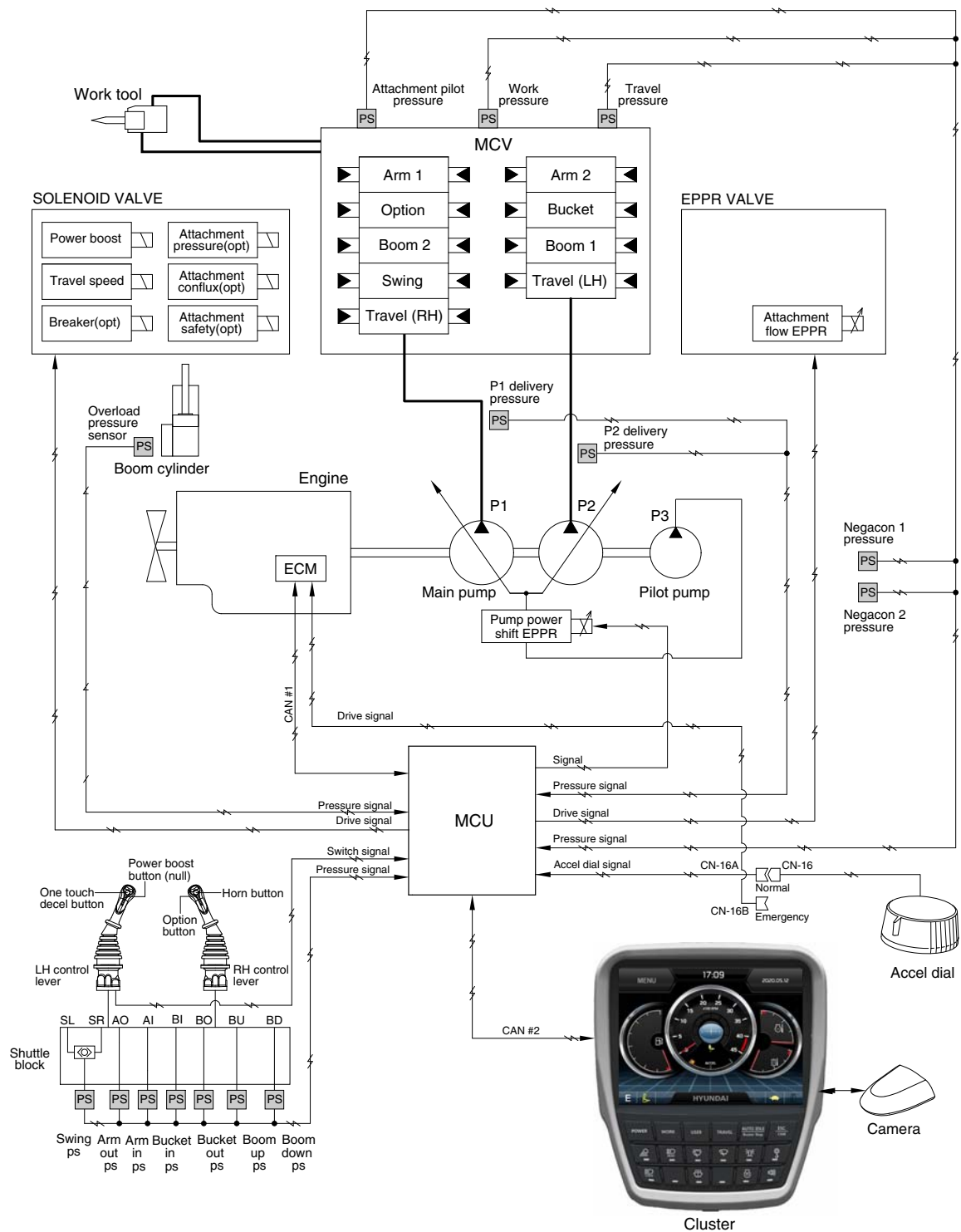
GROUP 1 OUTLINE

The ADVANCED CAPO (Computer Aided Power Optimization) system controls engine and pump mutual power at an optimum and less fuel consuming state for the selected work by mode selection, auto-deceleration, power boost function, etc. It monitors machine conditions, for instance, engine speed, coolant temperature, hydraulic oil temperature, and hydraulic oil pressure, etc.

It consists of a MCU, a cluster, an ECM, EPPR valves, and other components. The MCU and the cluster protect themselves from over-current and high voltage input, and diagnose malfunctions caused by short or open circuit in electric system, and display error codes on the cluster.



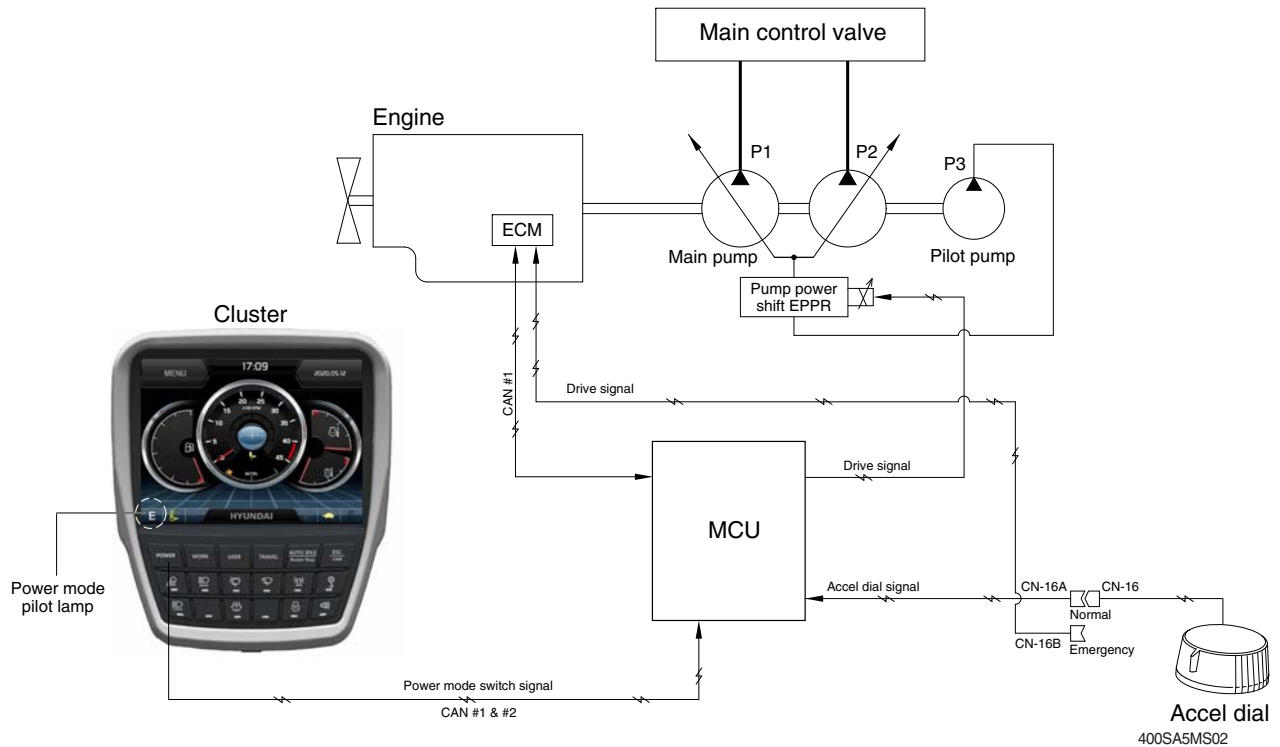
SYSTEM DIAGRAM



480SA5MS01

GROUP 2 MODE SELECTION SYSTEM

1. POWER MODE SELECTION SYSTEM



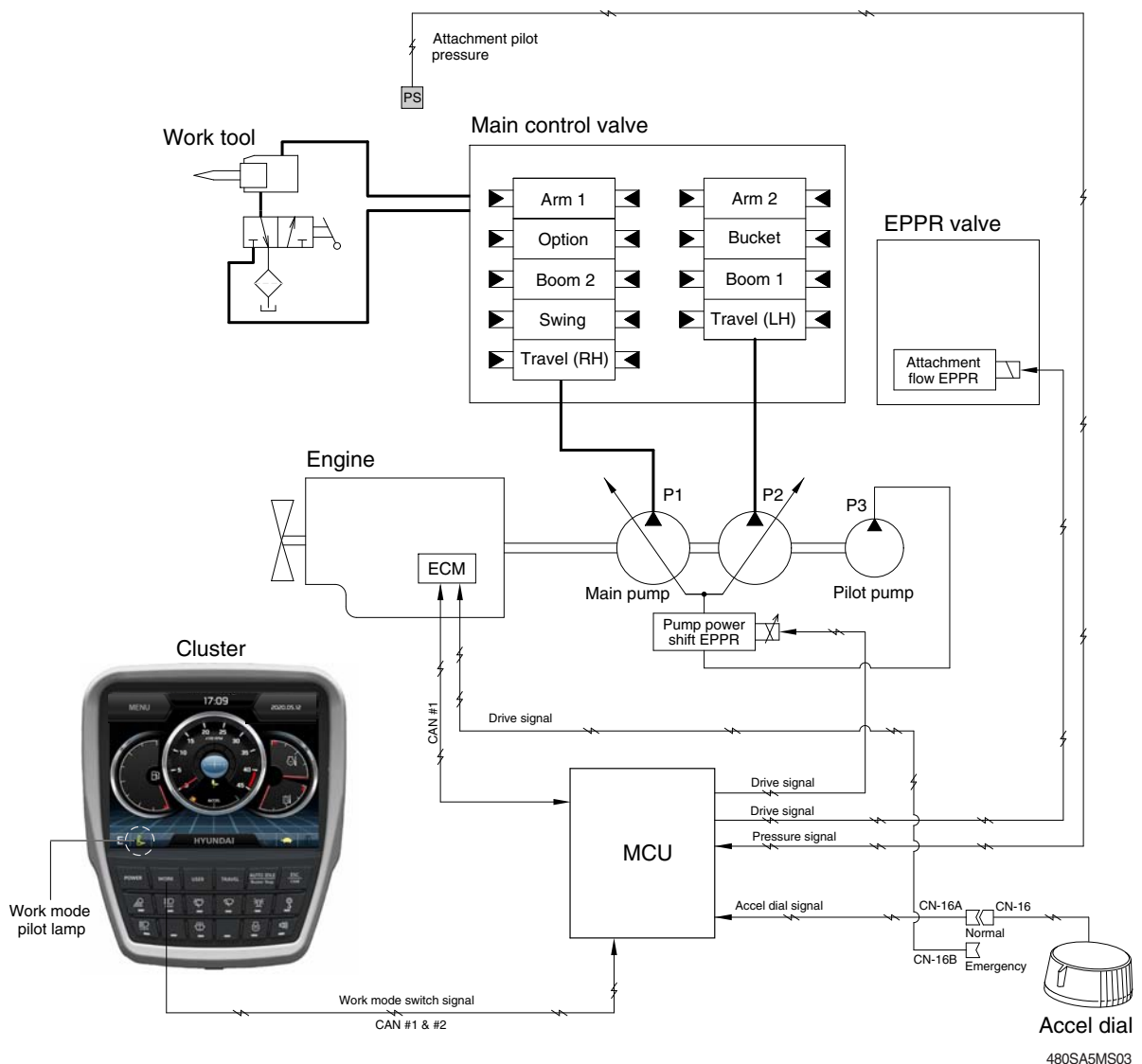
Mode selection system (micro computer based electro-hydraulic pump and engine mutual control system) optimizes the engine and pump performance.

The combination of 3 power modes (P, S, E) and acceleration mode (10 set) of haptic controller makes it possible to use the engine and pump power more effectively corresponding to the work conditions from a heavy and great power requesting work to a light and precise work.

Power mode		Engine rpm		Pressure (Pf)		
		No load	Load	No load	Load	
				-	Boom up full stroke & pump no relief	Boom up full stroke & pump relief
Standard	P	1700	1800	8.5	8~5	8
	S	1600	1700	9	8.5~5.5	8.5
	E	1500	1600	9	8.5~5.5	8.5
Option	P	1800	1800	5	5	5
	S	1700	1700	5.5	5.5	5.5
	E	1600	1600	5.5	5.5	5.5
Auto decel		1000	-	25	25	25
One touch decel		800	-	25	25	25
Key start (low idle)		800	-	25	25	25

2. WORK MODE SELECTION SYSTEM

Work mode consists of the general operation (bucket) and the optional attachment (breaker, crusher).



1) GENERAL WORK MODE (bucket)

This mode is used to general digging work.

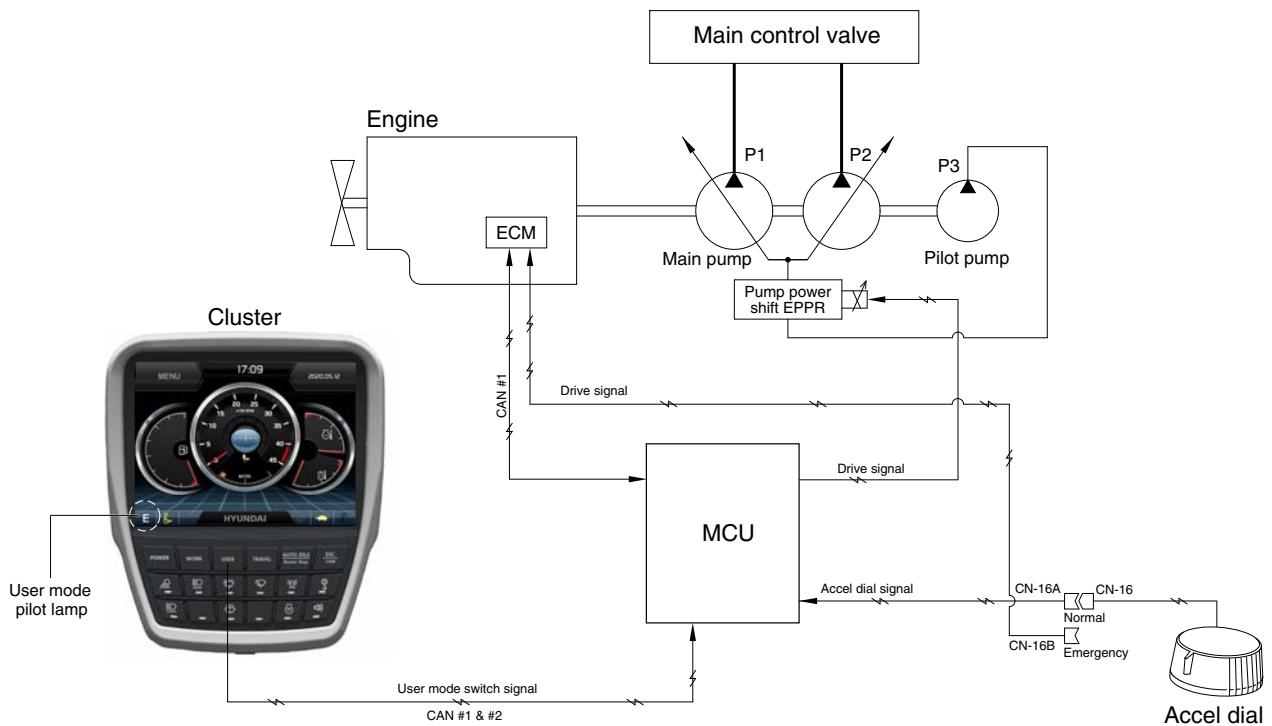
2) ATT WORK MODE (breaker, crusher)

It controls the pump flow and system pressure according to the operation of breaker or crusher.

Description	General mode	Work tool	
	Bucket	Breaker	Crusher
Attachment safety solenoid	OFF	-	ON
Attachment conflux solenoid	OFF	ON/OFF	ON/OFF
Attachment flow EPPR current	100 mA	100~700 mA	100~700 mA
Breaker solenoid★	OFF	ON	-

★ When breaker operating button is pushed.

3. USER MODE SELECTION SYSTEM



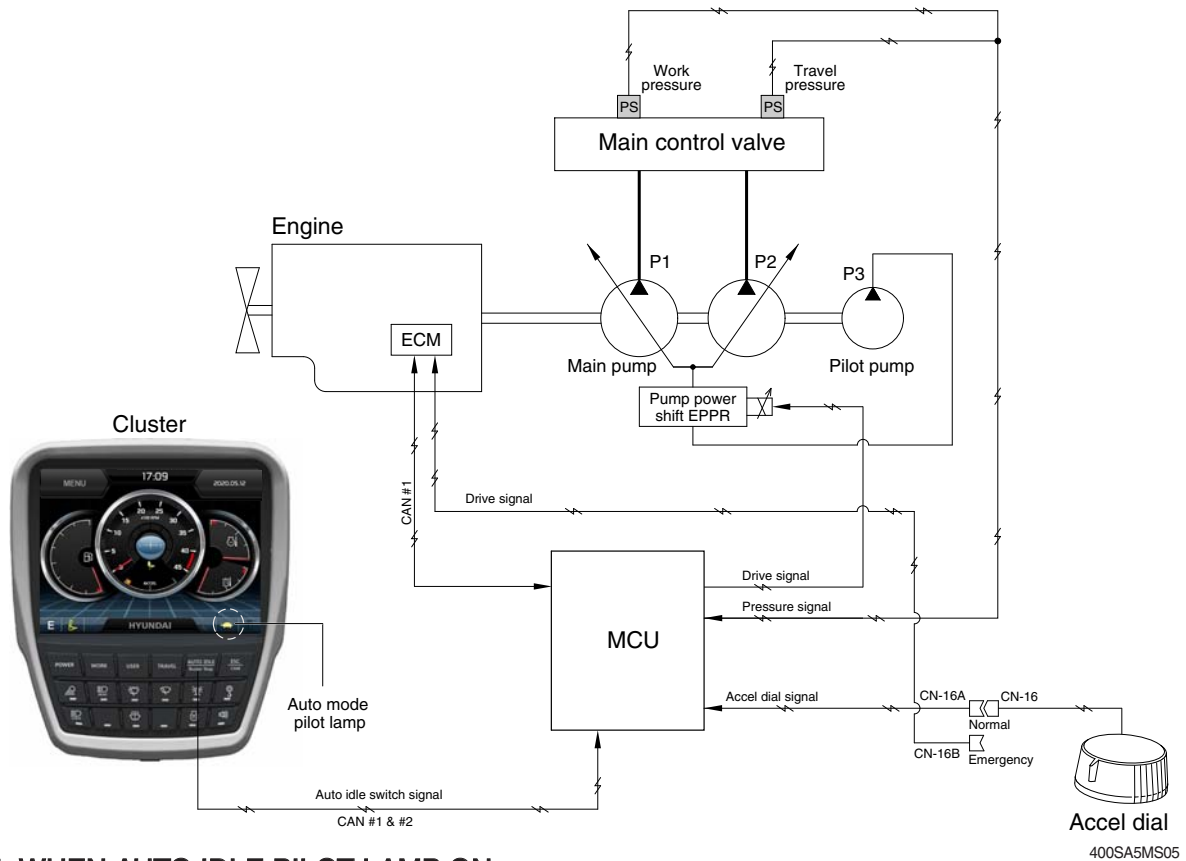
400SA5MS04

1) High idle rpm, auto idle rpm and EPPR pressure can be adjusted and memorized in the U-mode.

2) LCD segment vs parameter setting

Step ()	Engine speed (rpm)	Idle speed (rpm)	Power shift (bar)
1	1400	800	0
2	1450	850	2
3	1500	900	4
4	1550	950	7
5	1600	1000 (auto decel)	10
6	1650	1050	13
7	1700	1100	16
8	1750	1150	19
9	1800	1200	22
10	1850	1250	25

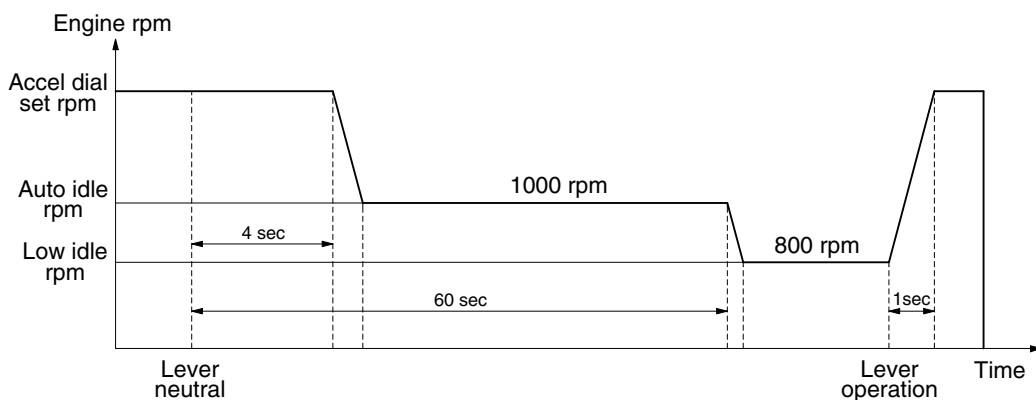
GROUP 3 AUTOMATIC DECELERATION SYSTEM



1. WHEN AUTO IDLE PILOT LAMP ON

When all of the work equipment control levers including swing and travel levers are at neutral for 4 seconds, MCU drive the governor moter to reduce the engine speed to 1000 rpm. If the control levers are at neutral for 1 minute, MCU reduces the engine speed to 800 rpm. As the result of reducing the engine speed, fuel consumption and noise are effectively cut down during non-operation of the control levers.

When the auto idle pilot lamp is turned off by pressing the switch or any control lever is operated, the reduced engine speed rises upto the speed before deceleration in a second.



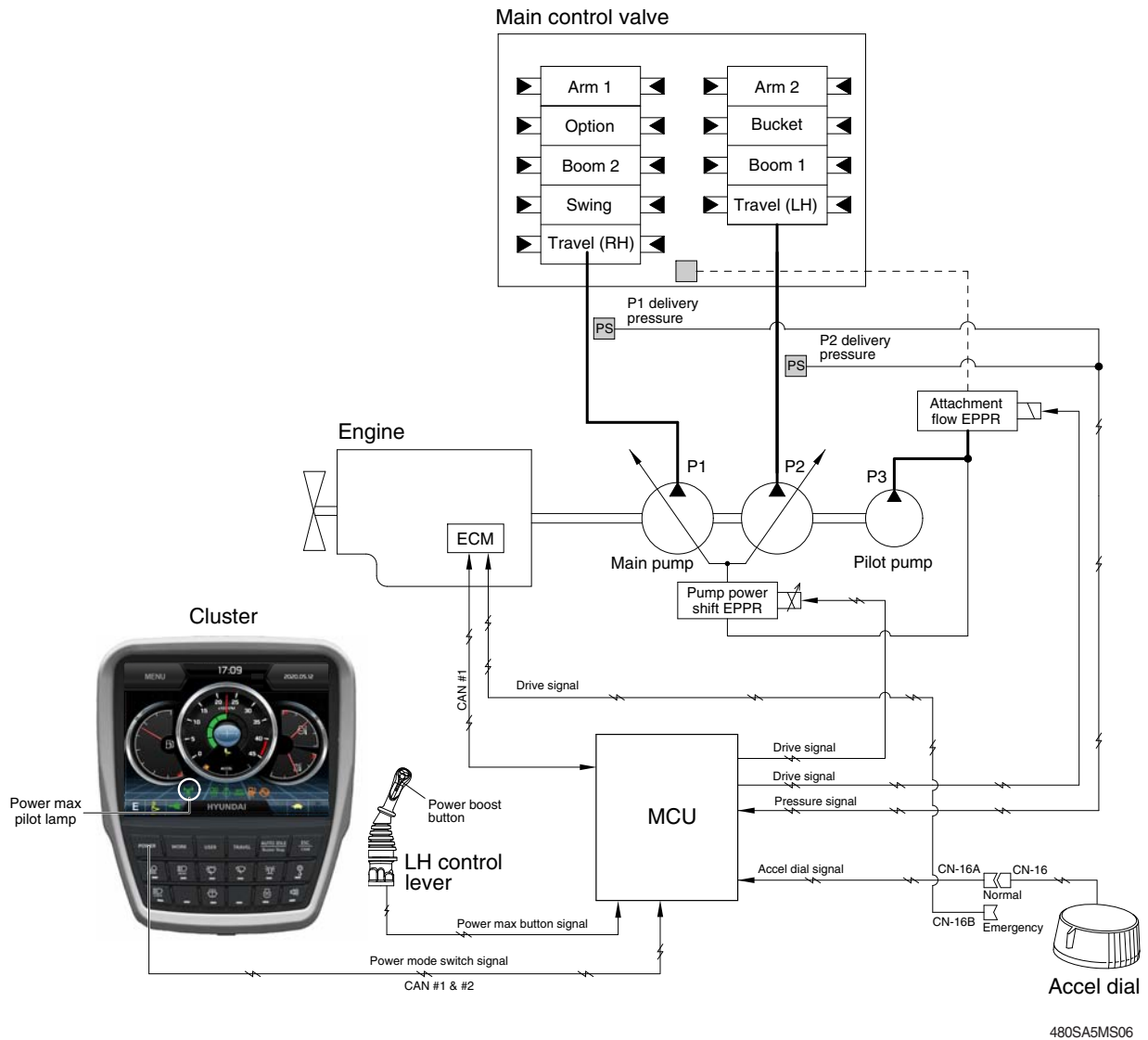
480SA5MS56

2. WHEN AUTO IDLE PILOT LAMP OFF

The engine speed can be set as desired using the accel dial switch, and even if the control levers are neutral, the engine speed is not reduced.

※ Auto idle function can be activated when accel dial position is over 4.

GROUP 4 POWER BOOST SYSTEM (NULL)

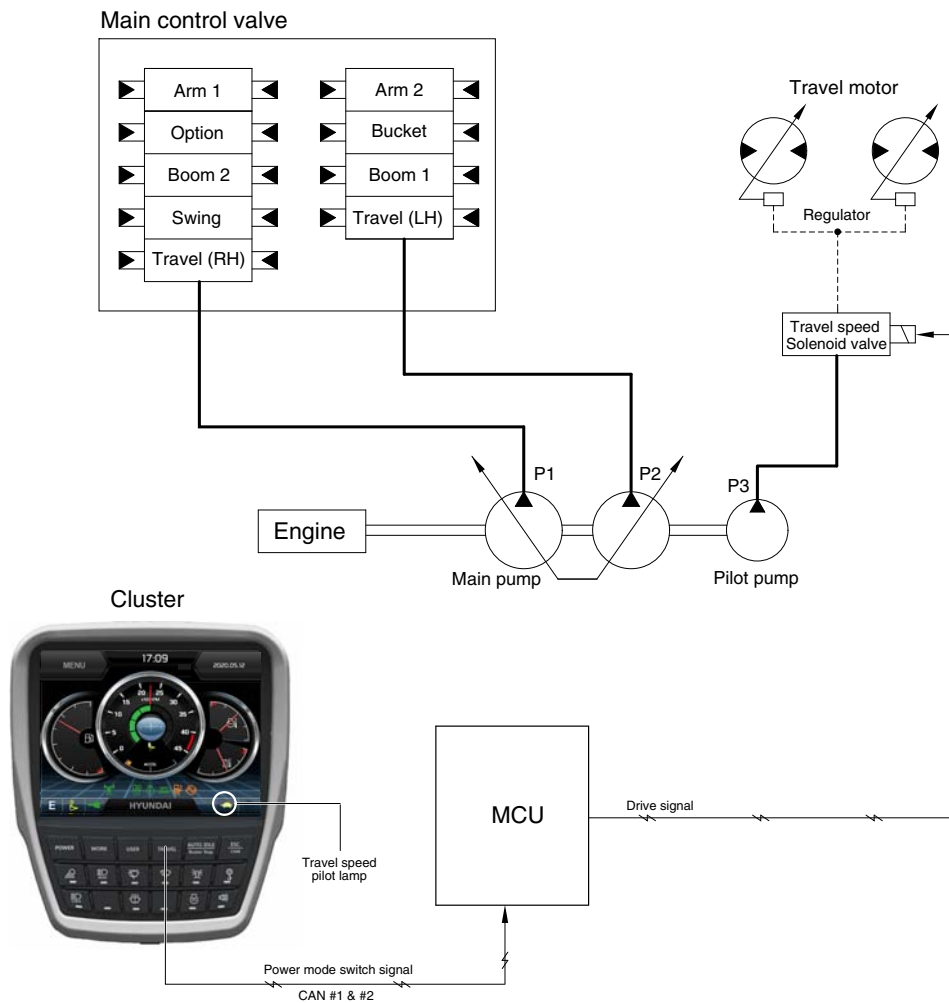


- When the power boost switch on the left control lever knob is pushed ON, the power mode is set P mode and maximum digging power is increased by 10 %.
- When the power boost function is activated, the power boost solenoid valve pilot pressure raises the set pressure of the main relief valve to increase the digging power.

Description	Condition	Function
Activated	Power boost switch : ON Multimodal dial : over 8	<ul style="list-style-type: none"> - Power mode : P - Multimodal dial power : 9 - Power boost solenoid : ON - Power boost pilot lmap : ON - Operating time : max 8 seconds
Canceled	Power boost switch : OFF	<ul style="list-style-type: none"> - Pre-set power mode - Power boost solenoid : OFF - Power boost pilot lamp : OFF

※ When the auto power boost is set to enable and power mode is set to P mode on the cluster, the digging power is automatically increased as working conditions by the MCU. It is operated max 8 seconds.

GROUP 5 TRAVEL SPEED CONTROL SYSTEM



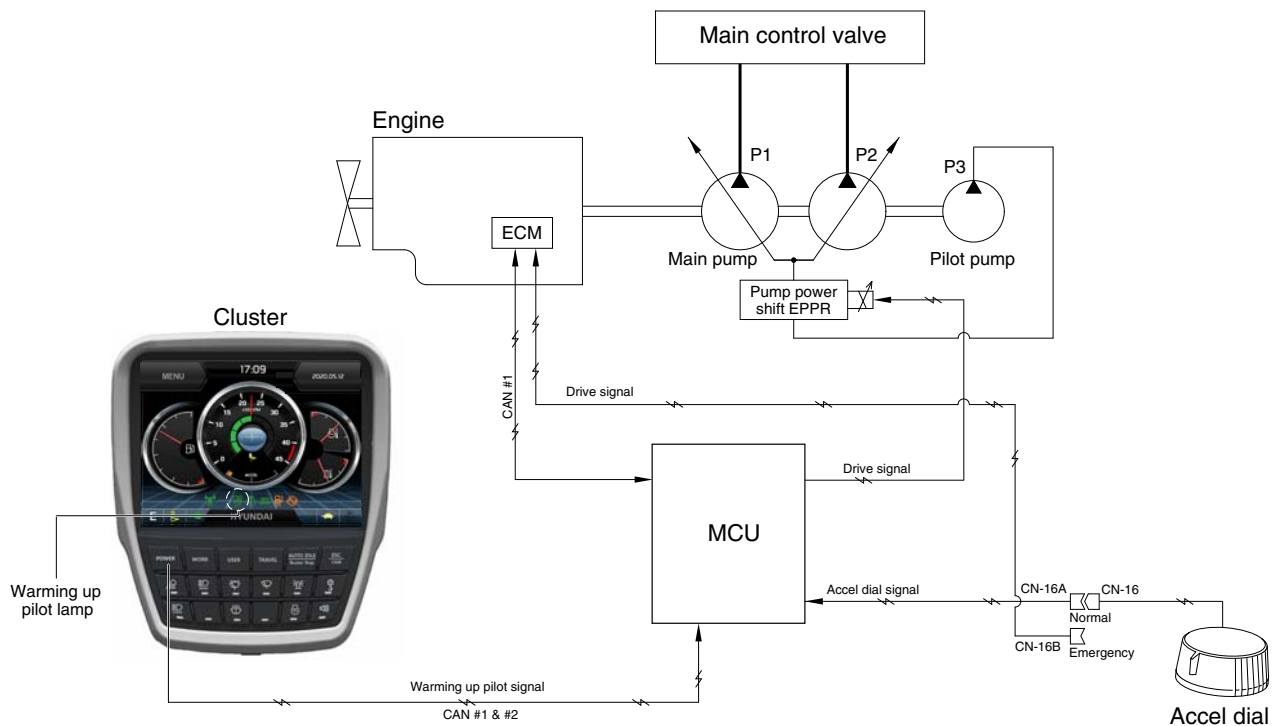
480SA5MS10

Travel speed can be switched manually by pressing the travel speed switch on the cluster.

Speed	Travel speed solenoid valve	Lamp on cluster	Operation
Low	OFF	Turtle	Low speed, high driving torque in the travel motor
High	ON	Rabbit	High speed, low driving torque in the travel motor

※ Default : Turtle (Low)

GROUP 6 AUTOMATIC WARMING UP SYSTEM



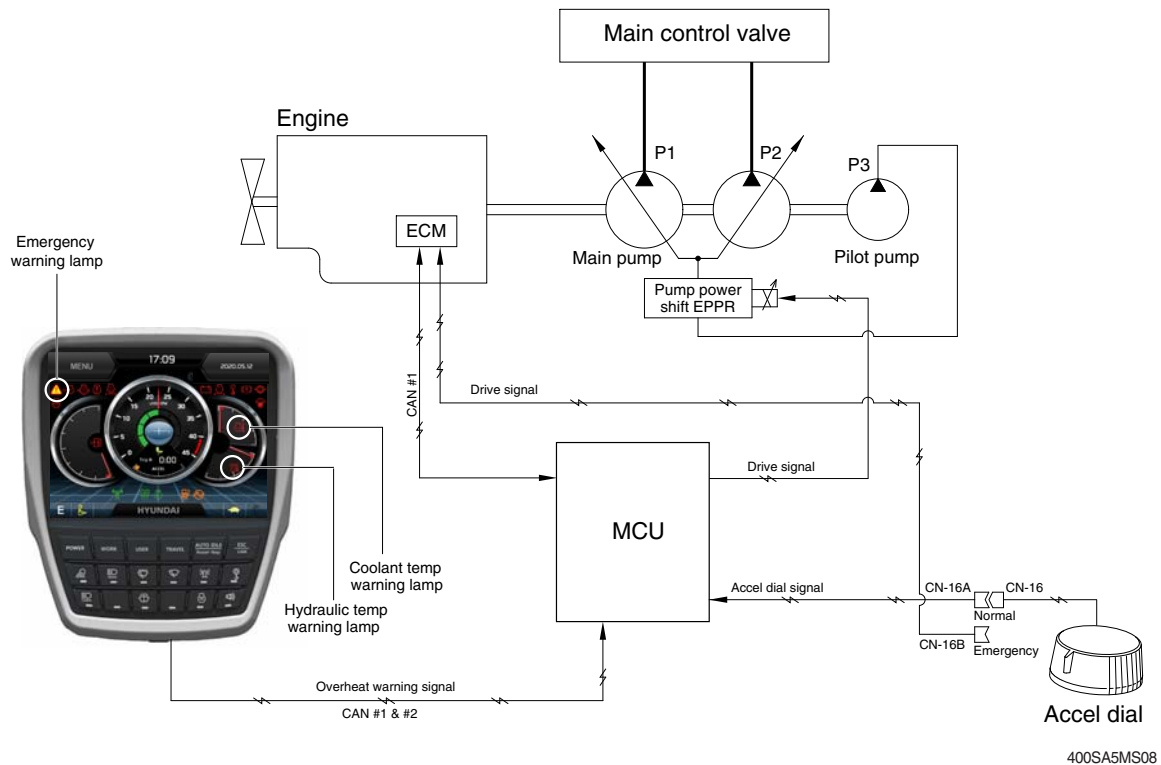
400SA5MS07

1. The MCU receives the engine coolant temperature through the temperature sensor, and if the coolant temperature is below 30°C, it increases the engine speed from key start rpm to 1400 rpm. At this time the mode does not change. If the coolant temperature sensor has fault, the hydraulic oil temperature signal is substituted.
2. In case of the coolant temperature increases up to 30°C, the engine speed is decreased to key start speed. And if an operator changes power mode set during the warming up function, the MCU cancels the automatic warming up function.

3. LOGIC TABLE

Description	Condition	Function
Actuated	- Coolant temperature : below 30°C (after engine run)	- Power mode : Default (E mode) - Warming up time : 10 minutes (max) - Warming up pilot lamp : ON
Canceled	- Coolant temperature : Above 30°C - Warming up time : Above 10 minutes - Changed power mode set by operator - RCV lever or pedal operating - Auto idle cancel ※ If any of the above conditions is applicable, the automatic warming up function is canceled	- Power mode : set mode - Warming up pilot lamp : OFF

GROUP 7 ENGINE OVERHEAT PREVENTION SYSTEM

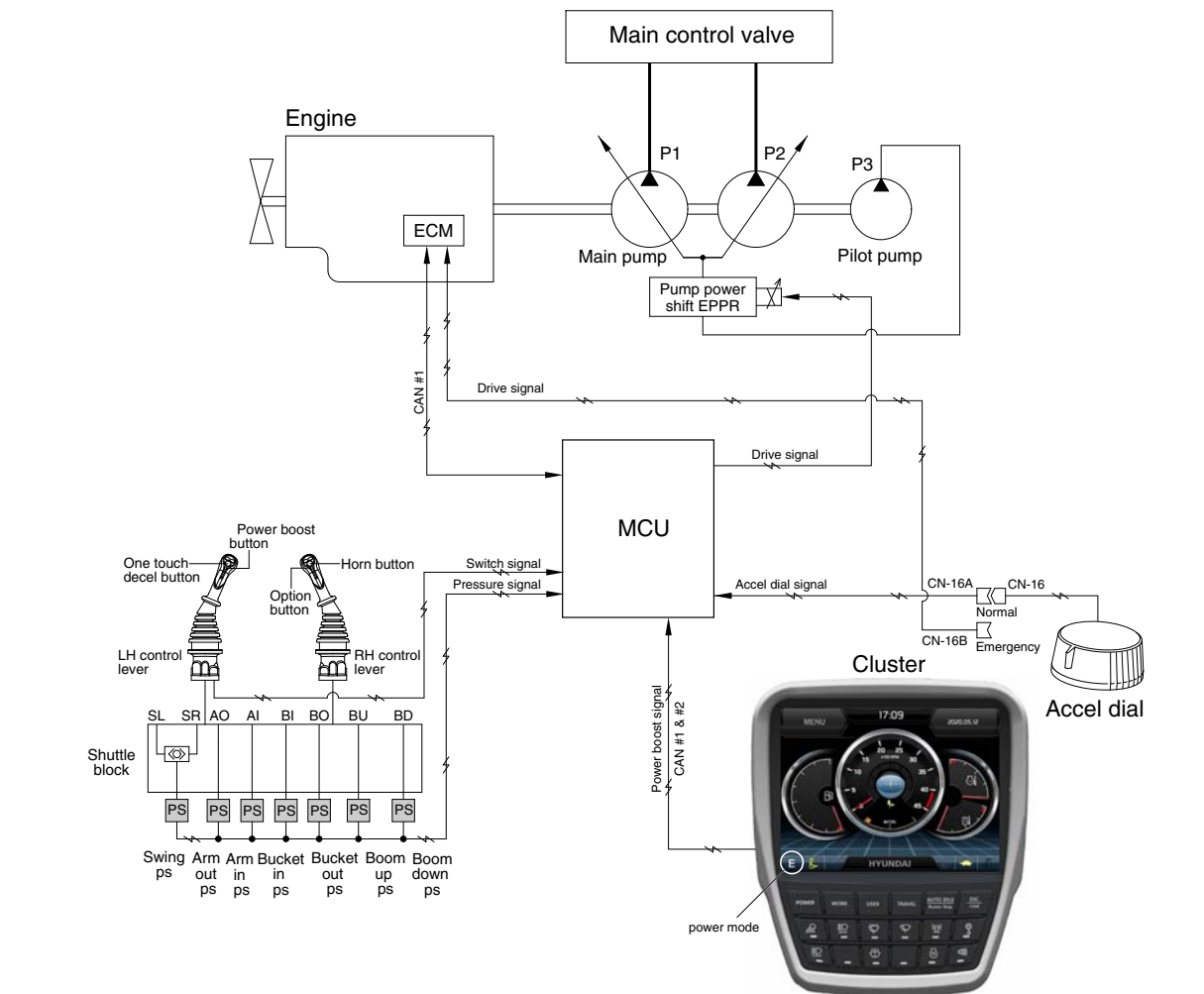


1. If the engine coolant temperature or the hydraulic oil temperature is overheated over 100°C, the warning lamp is ON and the pump input torque or the engine speed is reduced as below logic table.

2. LOGIC TABLE

Description		Condition	Function
First step warning	Activated	- Coolant temperature : Above 107°C - Hydraulic oil temperature : Above 100°C	- Warning lamp : ON , buzzer : OFF - Pump input torque is reduced.
	Canceled	- Coolant temperature : Less than 107°C - Hydraulic oil temperature : Less than 100°C	- Warning lamp & buzzer : ON - Pump input torque is reduced.
Second step warning	Activated	- Coolant temperature : Above 113°C - Hydraulic oil temperature : Above 105°C	- Emergency warning lamp pops up on the center of LCD and the buzzer sounds. - Engine speed is reduced after 10 seconds.
	Canceled	- Coolant temperature : Less than 107°C - Hydraulic oil temperature : Less than 100°C	- Return to pre-set the engine speed. - Hold pump absorption torque on the first step warning.

GROUP 8 VARIABLE POWER CONTROL SYSTEM



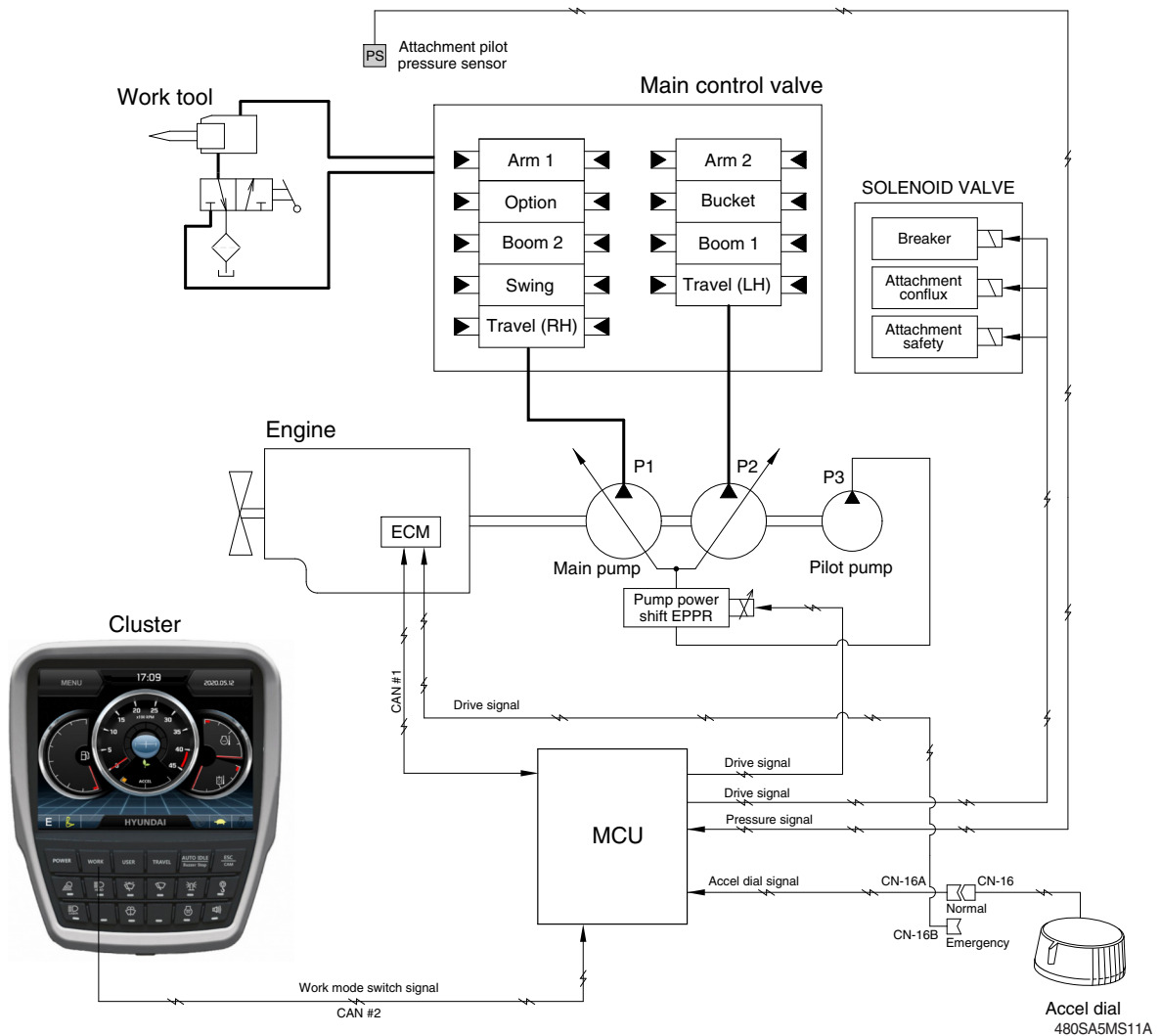
400SA5MS09

- The variable power control system controls the engine and pump mutual power according to RCV lever stroke and pump load.
It makes fuel saving and smooth control at precise work.

Description	Working condition
Power mode	P, S, E
Work mode	General (bucket)
Pressure sensor	Normal

※ The variable power control function can be activated when the power mode is set to all power mode.

GROUP 9 ATTACHMENT FLOW CONTROL SYSTEM



- The system is used to control the pump delivery flow according to set of the work tool on the cluster by the attachment flow EPPR valve.

Description	Work tool	
	Breaker	Crusher
Flow level	100 ~ 250 lpm	100 ~ 580 lpm
Attach safety solenoid	-	ON
Attach conflux solenoid	-	ON/OFF
Breaker solenoid★	ON	-

※ Refer to the page 5-73 for the attachment kinds and max flow.

★ When breaker operating button is pushed.

GROUP 10 INTELLIGENT POWER CONTROL SYSTEM



1. When the requirement of pump flow rate is low, IPC mode controls pump flow rate to improve fuel efficiency.

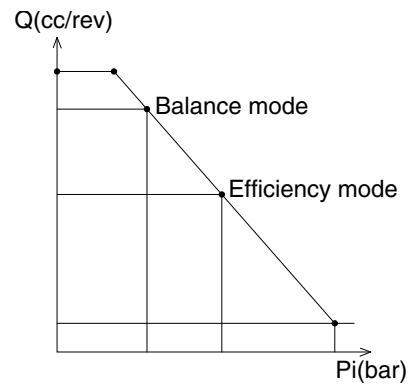
Condition★ ¹	Function
IPC mode : ON★ ² Boom up Arm in Not travel motion Not swing motion	Limitation of pump flow rate : Activated
None of upper condition	Limitation of pump flow rate : Canceled

★¹ AND condition

★² IPC mode ON/OFF is selected at "Mode setup > IPC mode". See next page.

2. IPC MODE SELECTION

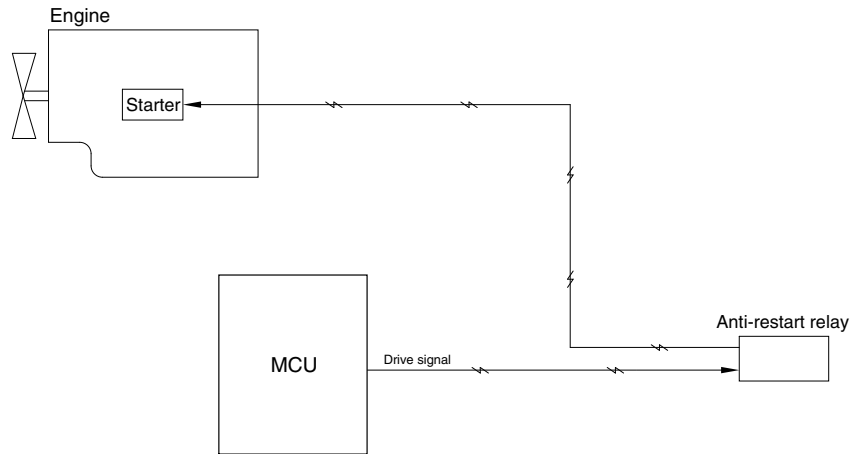
IPC mode ON/OFF and the levels of flow rate limit can be selected at "Mode setup > IPC mode"



145SA5MS19

IPC mode	Description
Balance mode (default)	IPC mode ON, limit level 1
Efficiency mode	IPC mode ON, limit level 2
Speed mode	IPC mode OFF

GROUP 11 ANTI-RESTART SYSTEM



220S5MS18

1. ANTI-RESTART FUNCTION

After a few seconds from the engine starts to run, MCU turns off the anti-start relay to protect the starter from inadvertent restarting.

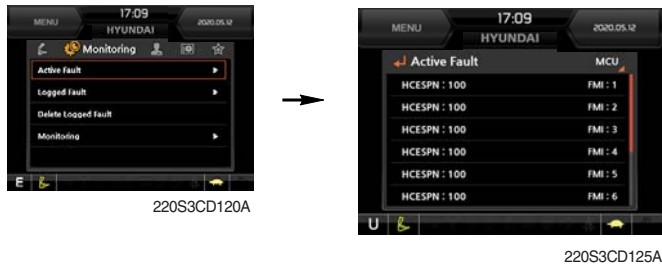
GROUP 12 SELF-DIAGNOSTIC SYSTEM

1. OUTLINE

When any abnormality occurs in the ADVANCED CAPO system caused by electric parts malfunction and by open or short circuit, the MCU diagnoses the problem and sends the error codes to the cluster and also stores them in the memory.

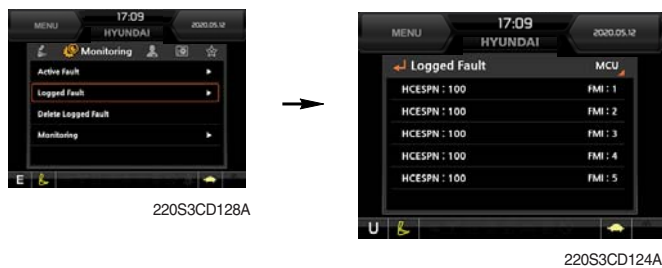
2. MONITORING

1) Active fault



- The active faults of the MCU can be checked by this menu.

2) Logged fault



- The logged faults of the MCU can be checked by this menu.

3) Delete logged fault



- The logged faults of the MCU can be deleted by this menu.

3. MACHINE ERROR CODES TABLE

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
101	3	10 seconds continuous, Hydraulic Oil Temp. Measurement Voltage > 3.8V	●		
	4	10 seconds continuous, Hydraulic Oil Temp. Measurement Voltage < 0.3V	●		
	(Results / Symptoms)				
	1. Monitor – Hydraulic oil temperature display failure 2. Control Function – Fan revolutions control failure (Checking list) 1. CD-1 (#2) – CN-52 (#24) Checking Open/Short 2. CD-1 (#1) – CN-51 (#11) Checking Open/Short				
105	0	10 seconds continuous, Working Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, $0.3V \leq$ Working Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Working Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Working Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure (Checking list) 1. CD-7 (#B) – CN-52 (#37) Checking Open/Short 2. CD-7 (#A) – CN-51 (#3) Checking Open/Short 3. CD-7 (#C) – CN-51 (#13) Checking Open/Short				
108	0	10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage > 5.2V		●	
	1	10 seconds continuous, $0.3V \leq$ Travel Oil Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Travel Oil Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure (Checking list) 1. CD-6 (#B) – CN-52 (#38) Checking Open/Short 2. CD-6 (#A) – CN-51 (#3) Checking Open/Short 3. CD-6 (#C) – CN-51 (#13) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General

C : Crawler Type

W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
120	0	10 seconds continuous, Main Pump 1 (P1) Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, $0.3V \leq$ Main Pump 1 (P1) Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Main Pump 1 (P1) Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Main Pump 1 (P1) Press. display failure 2. Control Function – Automatic voltage increase operation failure, Overload at compensation control failure (Checking list) 1. CD-42 (#B) – CN-52 (#29) Checking Open/Short 2. CD-42 (#A) – CN-51 (#3) Checking Open/Short 3. CD-42 (#C) – CN-51 (#13) Checking Open/Short				
121	0	10 seconds continuous, Main Pump 2 (P2) Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, $0.3V \leq$ Main Pump 2 (P2) Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Main Pump 2 (P2) Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Main Pump 2 (P2) Press. display failure 2. Control Function – Automatic voltage increase operation failure, Overload at compensation control failure (Checking list) 1. CD-43 (#B) – CN-52 (#30) Checking Open/Short 2. CD-43 (#A) – CN-51 (#3) Checking Open/Short 3. CD-43 (#C) – CN-51 (#13) Checking Open/Short				
122	1	(when you had conditions mounting pressure sensor) 10 seconds continuous, $0.3V \leq$ Overload Press. Sensor Measurement Voltage < 0.8V	●		
	4	(when you had conditions mounting pressure sensor) 10 seconds continuous, Overload Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Overload Press. display failure 2. Control Function – Overload warning alarm failure (Checking list) 1. CD-31 (#B) – CN-52 (#39) Checking Open/Short 2. CD-31 (#A) – CN-51 (#3) Checking Open/Short 3. CD-31 (#C) – CN-51 (#13) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General

C : Crawler Type

W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
123	0	10 seconds continuous, Negative 1 Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, $0.3V \leq$ Negative 1 Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Negative 1 Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Negative 1 Press. display failure 2. Control Function – IPC operation failure, Option attachment flow control operation failure (Checking list) 1. CD-70 (#B) – CN-51 (#39) Checking Open/Short 2. CD-70 (#A) – CN-51 (#3) Checking Open/Short 3. CD-70 (#C) – CN-51 (#13) Checking Open/Short				
124	0	10 seconds continuous, Negative 2 Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, $0.3V \leq$ Negative 2 Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Negative 2 Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Negative 2 Press. display failure 2. Control Function – Option attachment flow control operation failure (Checking list) 1. CD-71 (#B) – CN-51 (#40) Checking Open/Short 2. CD-71 (#A) – CN-51 (#3) Checking Open/Short 3. CD-71 (#C) – CN-51 (#13) Checking Open/Short				
127	0	10 seconds continuous, Boom Up Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, $0.3V \leq$ Boom Up Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Boom Up Pilot Press. Sensor Measurement < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Boom Up Pilot Press. display failure 2. Control Function – Engine/Pump variable horse power control operation failure, IPC operation failure, Boom first operation failure (Checking list) 1. CD-32 (#B) – CN-52 (#35) Checking Open/Short 2. CD-32 (#A) – CN-51 (#3) Checking Open/Short 3. CD-32 (#C) – CN-5 1(#13) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General

C : Crawler Type

W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
128	0	(when you had conditions mounting pressure sensor) 10 seconds continuous, Boom Down Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	(when you had conditions mounting pressure sensor) 10 seconds continuous, $0.3V \leq$ Boom Down Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	(when you had conditions mounting pressure sensor) 10 seconds continuous, Boom Down Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Boom Down Pilot Press. display failure 2. Control Function – Boom floating operation failure (Checking list) 1. CD-85 (#B) – CN-52 (#34) Checking Open/Short 2. CD-85 (#A) – CN-51 (#3) Checking Open/Short 3. CD-85 (#C) – CN-51 (#13) Checking Open/Short				
129	0	10 seconds continuous, Arm In Pilot Press. Sensor Measurement Voltage > 4.8V	●		
	1	10 seconds continuous, $0.3V \leq$ Arm In Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Arm In Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Arm In Pilot Press. display failure 2. Control Function – IPC operation failure (Checking list) 1. CD-90 (#B) – CN-51 (#10) Checking Open/Short 2. CD-90 (#A) – CN-51 (#3) Checking Open/Short 3. CD-90 (#C) – CN-51 (#13) Checking Open/Short				
133	0	10 seconds continuous, Bucket in Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, $0.3V \leq$ Bucket in Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Bucket in Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Bucket in Pilot Press. display failure 2. Control Function – Engine variable horse power control operation failure (Checking list) 1. CD-35 (#B) – CN-52 (#28) Checking Open/Short 2. CD-35 (#A) – CN-51 (#3) Checking Open/Short 3. CD-35 (#C) – CN-51 (#13) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General

C : Crawler Type

W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
135	0	10 seconds continuous, Swing Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V ≤ Swing Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Swing Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Swing Pilot Press. display failure 2. Control Function – IPC operation, Boom first operation failure (Checking list) 1. CD-24 (#B) – CN-52 (#36) Checking Open/Short 2. CD-24 (#A) – CN-51 (#3) Checking Open/Short 3. CD-24 (#C) – CN-51 (#13) Checking Open/Short				
138	0	Monitor – Select Attachment(breaker / crusher) 10 seconds continuous, Attachment Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	Monitor – Select Attachment(breaker / crusher) 10 seconds continuous, 0.3V ≤ Attachment Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	Monitor – Select Attachment(breaker / crusher) 10 seconds continuous, Attachment Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Attachment Pilot Press. display failure 2. Control Function – Option attachment flow control operation failure (Checking list) 1. CD-69 (#B) – CN-52 (#33) Checking Open/Short 2. CD-69 (#A) – CN-51 (#3) Checking Open/Short 3. CD-69 (#C) – CN-51 (#13) Checking Open/Short				
139 (NA)	1	10 seconds continuous, 0.3V ≤ Option Pilot Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Option Pilot Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Option Pilot Press. display failure 2. Control Function – Auto Idle operation failure (Checking list) 1. CD-100 (#B) – CN-52 (#21) Checking Open/Short 2. CD-100 (#A) – CN-51 (#3) Checking Open/Short 3. CD-100 (#C) – CN-1 (#6) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General

C : Crawler Type

W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
143 (NA)	5	(Detection) (When Travel EPPR Current is more than 10 mA) 10 seconds continuous, Travel EPPR drive current = 0 mA (Cancellation) (When Travel EPPR Current is more than 100 mA) 3 seconds continuous, Travel EPPR drive current \geq 10 mA			●
	6	(Detection) 10 seconds continuous, Travel EPPR drive current > 1.0 A (Cancellation) 3 seconds continuous, Travel EPPR drive current \leq 1.0 A			●
	(Results / Symptoms) 1. Control Function – cruise control operation failure (Checking list) 1. CN-246 (#2) – CN-54 (#39) Checking Open/Short 2. CN-246 (#1) – CN-51 (#40) Checking Open/Short				
145	5	(Model Parameter) mounting Remote Cooling Fan EPPR (Detection) (When Remote Cooling Fan EPPR Current is more than 10 mA) 10 seconds continuous, Remote Cooling Fan EPPR drive current = 0 mA (Cancellation) (When Remote Cooling Fan EPPR Current is more than 10 mA) 3 seconds continuous, Remote Cooling Fan EPPR drive current \geq 10 mA	●		
	6	(Detection) 10 seconds continuous, Remote Cooling Fan EPPR drive current > 1.0 A (Cancellation) 3 seconds continuous, Remote Cooling Fan EPPR drive current \leq 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Remote fan control operation failure (Checking list) 1. CN-154 (#1) – CN-52 (#21) Checking Open/Short 2. CN-154 (#2) – CN-52 (#22) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General

C : Crawler Type

W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
164 (NA)	4	(Detection) (When Working Cutoff Relay is Off) 10 seconds continuous, Working Cutoff Relay drive unit Measurement Voltage $\leq 3.0V$ (Cancellation) (When Working Cutoff Relay is Off) 3 seconds continuous, Working Cutoff Relay drive unit Measurement Voltage $> 3.0V$			●
	6	(Detection) (When Working Cutoff Relay is On) 10 seconds continuous, Working Cutoff Relay drive current $> 6.5 A$ (Cancellation) (When Working Cutoff Relay is On) 3 seconds continuous, Working Cutoff Relay drive current $\leq 6.5 A$			●
	(Results / Symptoms) 1. Control Function – (Wheel Excavator) In driving mode, attachment hydraulic pilot pressure cut off failure (Checking list) 1. CR-47 (#85) – CN-54 (#9) Checking Open/Short 2. CR-47 (#30, #86) – Fuse box (#28) Checking Open/Short				
166	4	(Detection) (When Power Max Solenoid is Off) 10 seconds continuous, Power Max Solenoid drive unit Measurement Voltage $\leq 3.0V$ (Cancellation) (When Power Max Solenoid is Off) 3 seconds continuous, Power Max Solenoid drive unit Measurement Voltage $> 3.0V$	●		
	6	(Detection) (When Power Max Solenoid is On) 5 seconds continuous, Power Max Solenoid drive current $> 4.5 A$ (Cancellation) (When Power Max Solenoid is On) 3 seconds continuous, Power Max Solenoid drive current $\leq 4.5 A$	●		
	(Results / Symptoms) 1. Control Function – Voltage increase operation failure (Checking list) 1. CN-88 (#1) – CN-52 (#2) Checking Open/Short 2. CN-88 (#2) – Fuse box (#30) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General

C : Crawler Type

W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
167		(Detection) (When Travel Speed Solenoid is Off) 10 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage $\leq 3.0V$ (Cancellation) (When Travel Speed Solenoid is Off) 3 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage $> 3.0V$		●	
		4 (When Parking mode is not) (Detection) (When Travel Speed Solenoid is Off) 10 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage $\leq 3.0V$ (Cancellation) (When Travel Speed Solenoid is Off) 3 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage $> 3.0V$			●
	6	(Detection) (When Travel Speed Solenoid is On) 10 seconds continuous, Travel Speed Solenoid drive current $> 4.5 A$ (Cancellation) (When Travel Speed Solenoid is On) 3 seconds continuous, Travel Speed Solenoid drive current $\leq 4.5 A$	●		
	(Results / Symptoms) 1. Control Function – driving in 1/2 transmission operation failure (Checking list) 1. CN-70 (#1) – CN-52 (#3) Checking Open/Short 2. CN-70 (#2) – Fuse box (#30) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General

C : Crawler Type

W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
169	4	Monitor – Selecting attachment(breaker / crusher) (Detection) (When Attachment Conflux Solenoid is Off) 10 seconds continuous, Attachment Conflux Solenoid drive unit Measurement Voltage $\leq 3.0V$ (Cancellation) (When Attachment Conflux Solenoid is Off) 3 seconds continuous, Attachment Conflux Solenoid drive unit Measurement Voltage $> 3.0V$	●		
	6	(Detection) (When Attachment Conflux Solenoid is On) 10 seconds continuous, Attachment Conflux Solenoid drive Current $> 6.5 A$ (Cancellation) (When Attachment Conflux Solenoid is On) 3 seconds continuous, Attachment Conflux Solenoid drive Current $\leq 6.5 A$	●		
	(Results / symptoms) 1. Control Function – Option attachment flow control – Joining operation failure (Eco breaker mode, crusher mode) (Checking list) 1. CN-237 (#1) – CN-52 (#6) Checking Open/Short 2. CN-237 (#2) – Fuse box (#30) Checking Open/Short				
170 (NA)	4	(Model Parameter) mounting Arm Regenerating Solenoid (Detection) (When Arm Regeneration Solenoid is Off) 10 seconds continuous, Arm Regeneration Solenoid drive unit Measurement Voltage $\leq 3.0V$ (Cancellation) (When Arm Regeneration Solenoid is Off) 3 seconds continuous, Arm Regeneration Solenoid drive unit Measurement Voltage $> 3.0V$	●		
	6	(Detection) (When Arm Regeneration Solenoid is On) 10 seconds continuous, Arm Regeneration Solenoid drive current $> 4.5 A$ (Cancellation) (When Arm Regeneration Solenoid is On) 3 seconds continuous, Arm Regeneration Solenoid drive current $\leq 4.5 A$	●		
	(Results / symptoms) 1. Control Function – Arm regeneration operation failure (Checking list) 1. CN-135 (#1) – CN-52 (#1) Checking Open/Short 2. CN-135 (#2) – Fuse box (#28) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General

C : Crawler Type

W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
171	4	Monitor – Selecting attachment(crusher) (Detection) (When Attachment Safety Solenoid is Off) 10 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage $\leq 3.0V$ (Cancellation) (When Attachment Safety Solenoid is Off) 3 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage $> 3.0V$	●		
		(Detection) (When Attachment Safety Solenoid is On) 10 seconds continuous, Attachment Safety Solenoid drive current $> 6.5 A$ (Cancellation) (When Attachment Safety Solenoid is On) 3 seconds continuous, Attachment Safety Solenoid drive current $\leq 6.5 A$	●		
	(Results / Symptoms) 1. Control Function – Option attachment flow control – Option spool pilot pressure cut off failure (crusher mode) (Checking list) 1. CN-149 (#1) – CN-52 (#4) Checking Open/Short 2. CN-149 (#2) – Fuse box (#30) Checking Open/Short				
179	4	Monitor – Selecting attachment(breaker / crusher) (Detection) (When Breaker Operating Solenoid is Off) 10 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage $\leq 3.0V$ (Cancellation) (When Breaker Operating Solenoid is Off) 3 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage $> 3.0V$	●		
		(Detection) (When Breaker Operating Solenoid is On) 10 seconds continuous, Attachment Safety Solenoid drive current $> 6.5 A$ (Cancellation) (When Breaker Operating Solenoid is On) 3 seconds continuous, Attachment Safety Solenoid drive current $\leq 6.5 A$	●		
	(Results / Symptoms) 1. Control Function – Option attachment flow control – Breaker operation failure (breaker mode) (Checking list) 1. CN-66 (#1) – Ground Checking Open/Short 2. CN-66 (#2) – CR-62 (#5) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General

C : Crawler Type

W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
181	4	(Model Parameter) mounting Reverse Cooling Fan Solenoid (Detection) (When Reverse Cooling Fan Solenoid is Off) 10 seconds continuous, Reverse Cooling Fan Solenoid drive unit Measurement Voltage $\leq 3.0V$ (Cancellation) (When Reverse Cooling Fan Solenoid is Off) 3 seconds continuous, Reverse Cooling Fan Solenoid drive unit Measurement Voltage $> 3.0V$	●		
	6	(Detection) (When Reverse Cooling Fan Solenoid is On) 10 seconds continuous, Reverse Cooling Fan Solenoid drive current $> 4.5 A$ (Cancellation) (When Reverse Cooling Fan Solenoid is On) 3 seconds continuous, Reverse Cooling Fan Solenoid drive current $\leq 4.5 A$	●		
	(Results / Symptoms) 1. Control Function – Cooling Fan reverse control operation failure (Checking list) 1. CN-680 (#1) – CN-52 (#11) Checking Open/Short 2. CN-680 (#2) – fuse box (#30) Checking Open/Short				
188	5	(Detection) (When Attachment Flow EPPR 1 current is equal or more than 300 mA) 10 seconds continuous, Attachment Flow EPPR drive current $< 100 mA$ (Cancellation) (When Attachment Flow EPPR 1 current is equal or more than 300 mA) 3 seconds continuous, Attachment Flow EPPR drive current $\geq 100 mA$	●		
	6	(Detection) 10 seconds continuous, Attachment Flow EPPR 1 drive current $> 1.0 A$ (Cancellation) 3 seconds continuous, Attachment Flow EPPR 1 drive current $\leq 1.0 A$	●		
	(Results / Symptoms) 1. Control Function – IPC operation failure, Option attachment flow control operation failure (Checking list) 1. CN-242 (#2) – CN-52 (#10) Checking Open/Short 2. CN-242 (#1) – CN-52 (#20) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General

C : Crawler Type

W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
189	5	(Detection) (When Attachment Flow EPPR 2 current is equal or more than 300 mA) 10 seconds continuous, Attachment Flow EPPR drive current < 100 mA (Cancellation) (When Attachment Flow EPPR 2 current is equal or more than 300 mA) 3 seconds continuous, Attachment Flow EPPR drive current ≥ 100 mA	●		
		(Detection) 10 seconds continuous, Attachment Flow EPPR 2 drive current > 1.0 A (Cancellation) 3 seconds continuous, Attachment Flow EPPR 2 drive current ≤ 1.0 A	●		
	6	(Results / Symptoms) 1. Control Function – Option attachment flow control operation failure (Checking list) 1. CN-242A (#2) – CN-52 (#40) Checking Open/Short 2. CN-242A (#1) – CN-52 (#16) Checking Open/Short			
196 (NA)	0	HW145 10 seconds continuous, Attachment flow control EPPR 1 press. Sensor Measurement Voltage > 5.2V			
	1	HW145 10 seconds continuous, 0.3V ≤ Attachment flow control EPPR 1 press. Sensor Measurement Voltage < 0.8V			
	4	HW145 10 seconds continuous, Attachment flow control EPPR 1 press. Sensor Measurement Voltage < 0.3V			
		(Results / Symptoms) 1. Control Function – Driving second pump joining function operation failure (Checking list) 1. CD-93 (#B) – CN-52 (#34) Checking Open/Short 2. CD-93 (#A) – CN-51 (#32) Checking Open/Short 3. CD-93 (#C) – CN-51 (#31) Checking Open/Short			
200	0	10 seconds continuous, Pump EPPR Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V ≤ Pump EPPR Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Pump EPPR Press. Sensor Measurement Voltage < 0.3V	●		
		(Results / Symptoms) 1. Monitor – Pump EPPR Press. display failure 2. Control Function – Pump input horse power control failure, Overload at compensation control operation failure (Fuel efficiency/speed performance failure) (Checking list) 1. CD-44 (#B) – CN-52 (#32) Checking Open/Short 2. CD-44 (#A) – CN-51 (#3) Checking Open/Short 3. CD-44 (#C) – CN-51 (#13) Checking Open/Short			

※ Some error codes are not applied to this machine.

G : General

C : Crawler Type

W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
205 (NA)	0	(Mounting pressure sensor) 10 seconds continuous, Boom Cylinder Rod Press. Sensor Measurement Voltage > 5.2V	●		
	1	(Mounting pressure sensor) 10 seconds continuous, 0.3V ≤ Boom Cylinder Rod Press. Sensor Measurement Voltage < 0.8V	●		
	4	(Mounting pressure sensor) 10 seconds continuous, Boom Cylinder Rod Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Boom Cylinder Rod Press. display failure 2. Control Function – Boom floating control operation failure (Checking list) 1. CD-124 (#B) – CN-53 (#5) Checking Open/Short 2. CD-124 (#A) – CN-53 (#3) Checking Open/Short 3. CD-124 (#C) – CN-53 (#13) Checking Open/Short				
218 (NA)	4	Mounting pressure sensor (HCESPN128 or HCESPN 205) (Detection) (When Boom Up Floating Solenoid is Off) 10 seconds continuous, Boom Up Floating Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Boom Up Floating Solenoid is Off) 3 seconds continuous, Boom Up Floating Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Boom Up Floating Solenoid is On) 10 seconds continuous, Boom Up Floating Solenoid drive current > 6.5 A (Cancellation) (When Boom Up Floating Solenoid is On) 3 seconds continuous, Boom Up Floating Solenoid drive current ≤ 6.5 A	●		
	(Results / Symptoms) 1. Control Function – Boom floating control operation failure (Checking list) 1. CN-368 (#1) – CN-53 (#20) Checking Open/Short 2. CN-368 (#2) – Fuse box (#17) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General

C : Crawler Type

W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
220 (NA)	4	Mounting pressure sensor (HCESPN 128 or 205) (Detection) (When Boom Down Pilot Pressure Cutoff Solenoid is Off) 10 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive unit Measurement Voltage $\leq 3.0V$	●		
		(Cancellation) (When Boom Down Pilot Pressure Cutoff Solenoid is Off) 3 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive unit Measurement Voltage $> 3.0V$			
	6	(Detection) (When Boom Down Pilot Pressure Cutoff Solenoid is On) 10 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive current $> 6.5 A$ (Cancellation) (When Boom Down Pilot Pressure Cutoff Solenoid is On) 3 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive current $\leq 6.5 A$	●		
(Results / Symptoms) 1. Control Function – Boom floating control operation failure (Checking list) 1. CN-369 (#1) – CN-53 (#35) Checking Open/Short 2. CN-369 (#2) – Fuse box (#17) Checking Open/Short					
221 (NA)	5	Monitor – Selecting attachment(breaker / crusher) (Detection) (When ATT Relief Setting EPPR 1 Current is equal or more than 10 mA) 10 seconds continuous, ATT Relief Setting EPPR 1 drive current = 0 mA (Cancellation) ATT Relief Setting EPPR 1 Current is equal or more than 10 mA) 3 seconds continuous, ATT Relief Setting EPPR 1 drive current $\geq 10 mA$	●		
		(Detection) 10 seconds continuous, ATT Relief Setting EPPR 1 drive current $> 1.0 A$ (Cancellation) 3 seconds continuous, ATT Relief Setting EPPR 1 drive current $\leq 1.0 A$			
	6	(Detection) 10 seconds continuous, ATT Relief Setting EPPR 1 drive current $> 1.0 A$ (Cancellation) 3 seconds continuous, ATT Relief Setting EPPR 1 drive current $\leq 1.0 A$	●		
(Results / Symptoms) 1. Control Function – Option attachment flow control – P1 relief pressure setting failure (Checking list) 1. CN-365 (#2) – CN-53 (#39) Checking Open/Short 2. CN-365 (#1) – CN-53 (#40) Checking Open/Short					

※ Some error codes are not applied to this machine.

G : General

C : Crawler Type

W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
222 (NA)		Monitor – Selecting attachment(crusher) (Detection) (When ATT Relief Setting EPPR 2 Current is equal or more than 10 mA) 10 seconds continuous, ATT Relief Setting EPPR 2 drive current = 0 mA (Cancellation) (When ATT Relief Setting EPPR 2 Current is equal or more than 10 mA) 3 seconds continuous, ATT Relief Setting EPPR 2 drive current \geq 10mA	●		
	5	(Detection) 10 seconds continuous, ATT Relief Setting EPPR 2 drive current > 1.0 A (Cancellation) 3 seconds continuous, ATT Relief Setting EPPR 2 drive current \leq 1.0 A	●		
	6	(Results / Symptoms) 1. Control Function – Option attachment flow control – P2 relief pressure setting failure (Checking list) 1. CN-366 (#2) – CN-53 (#32) Checking Open/Short 2. CN-366 (#1) – CN-53 (#33) Checking Open/Short			
301	3	10 seconds continuous, Fuel Level Measurement Voltage > 3.8V	●		
	4	10 seconds continuous, Fuel Level Measurement Voltage < 0.3V	●		
		(Results / Symptoms) 1. Monitor – Fuel remaining display failure (Checking list) 1. CD-2 (#2) – CN-52 (#26) Checking Open/Short 2. CD-2 (#1) – CN-51 (#11) Checking Open/Short			
325	4	(Model Parameter) mounting Fuel Heater Relay (Detection) (When Fuel Heater Relay is Off) 10 seconds continuous, Fuel Heater Relay drive unit Measurement Voltage \leq 3.0V (Cancellation) (When Fuel Heater Relay is Off) 3 seconds continuous, Fuel Heater Relay drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Fuel Heater Relay is On) 10 seconds continuous, Fuel Heater Relay drive current > 4.5 A (Cancellation) (When Fuel Heater Relay is On) 3 seconds continuous, Fuel Heater Relay drive current \leq 4.5 A	●		
		(Results / Symptoms) 1. Control Function – Fuel heater operation failure (Checking list) 1. CR-46 (#85) – CN-52 (#12) Checking Open/Short 2. CR-46 (#30, #86) – Fuse box (#21) Checking Open/Short			

※ Some error codes are not applied to this machine.

G : General

C : Crawler Type

W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
501 (NA)	0	10 seconds continuous, Transmission Oil Press. Sensor Measurement Voltage > 5.2V			●
	1	10 seconds continuous, 0.3V ≤ Transmission Oil Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Transmission Oil Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Transmission Oil Press. display failure, Transmission Oil low pressure warning failure (Checking list) 1. CD-5 (#B) – CN-54 (#27) Checking Open/Short 2. CD-5 (#A) – CN-54 (#3) Checking Open/Short 3. CD-5 (#C) – CN-54 (#13) Checking Open/Short				
503 (NA)	0	10 seconds continuous, Brake Oil Press. Sensor Measurement Voltage > 5.2V			●
	1	10 seconds continuous, 0.3V ≤ Brake Oil Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Brake Oil Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Brake Oil Press. display failure, Brake Oil low pressure warning failure (Checking list) 1. CD-3 (#B) – CN-54 (#4) Checking Open/Short 2. CD-3 (#A) – CN-54 (#3) Checking Open/Short 3. CD-3 (#C) – CN-54 (#13) Checking Open/Short				
505 (NA)	0	10 seconds continuous, Working Brake Press. Sensor Measurement Voltage > 5.2V			●
	1	10 seconds continuous, 0.3V ≤ Working Brake Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Working Brake Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Working Brake Oil Press. display failure, Working Brake Oil low pressure warning failure (Checking list) 1. CD-38 (#B) – CN-54 (#5) Checking Open/Short 2. CD-38 (#A) – CN-54 (#3) Checking Open/Short 3. CD-38 (#C) – CN-54 (#13) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General

C : Crawler Type

W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
514 (NA)	4	(Detection) (When Parking Relay is Off) 10 seconds continuous, Parking Relay drive unit Measurement Voltage $\leq 3.0V$ (Cancellation) (When Parking Relay is Off) 3 seconds continuous, Parking Relay drive unit Measurement Voltage $> 3.0V$			●
	6	(Detection) (When Parking Relay is On) 10 seconds continuous, Parking Relay drive current $> 6.5 A$ (Cancellation) (When Parking Relay is On) 3 seconds continuous, Parking Relay drive current $\leq 6.5 A$			●
	(Results / Symptoms) 1. Control Function – Parking Relay operation failure (Checking list) 1. CR-66 (#1) – CN-54 (#20) Checking Open/Short 2. CR-66 (#2) – Fuse box (#30) Checking Open/Short				
517 (NA)	4	(Detection) (When Traveling Cutoff Relay is Off) 10 seconds continuous, Traveling Cutoff Relay drive unit Measurement Voltage $\leq 3.0V$ (Cancellation) (When Traveling Cutoff Relay is Off) 3 seconds continuous, Traveling Cutoff Relay drive unit Measurement Voltage $> 3.0V$			●
	6	(Detection) (When Traveling Cutoff Relay is On) 10 seconds continuous, Traveling Cutoff Relay drive current $> 6.5 A$ (Cancellation) (When Traveling Cutoff Relay is On) 3 seconds continuous, Traveling Cutoff Relay drive current $\leq 6.5 A$			●
	(Results / Symptoms) 1. Control Function – Traveling Cutoff Relay operation failure (Checking list) 1. CR-47 (#85) – CN-54 (#9) Checking Open/Short 2. CR-47 (#86) – Fuse box (#28) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General

C : Crawler Type

W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
525 (NA)	4	(Detection) (When Ram Lock Solenoid is Off) 10 seconds continuous, Ram Lock Solenoid drive unit Measurement Voltage $\leq 3.0V$ (Cancellation) (When Ram Lock Solenoid is Off) 3 seconds continuous, Ram Lock Solenoid drive unit Measurement Voltage $> 3.0V$			●
	6	(Detection) (When Ram Lock Solenoid is On) 10 seconds continuous, Ram Lock Solenoid drive current $> 6.5 A$ (Cancellation) (When Ram Lock Solenoid is On) 3 seconds continuous, Ram Lock Solenoid drive current $\leq 6.5 A$			●
	(Results / Symptoms) 1. Control Function – Ram lock control operation failure (Checking list) 1. CN-69 (#1) – CN-54 (#8) Checking Open/Short 2. CN-69 (#2) – Fuse box (#33) Checking Open/Short				
527 (NA)	4	(Detection) (When Creep Solenoid is Off) 10 seconds continuous, Creep Solenoid drive unit Measurement Voltage $\leq 3.0V$ (Cancellation) (When Creep Solenoid is Off) 3 seconds continuous, Creep Solenoid drive unit Measurement Voltage $> 3.0V$			●
	6	(Detection) (When Creep Solenoid is On) 10 seconds continuous, Creep Solenoid drive current $> 6.5 A$ (Cancellation) (When Creep Solenoid is On) 3 seconds continuous, Creep Solenoid drive current $\leq 6.5 A$			●
	(Results / Symptoms) 1. Control Function – Creep mode operation failure (Checking list) 1. CN-206 (#1) – CN-54 (#7) Checking Open/Short 2. CN-206 (#2) – Fuse box (#30) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General

C : Crawler Type

W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
530 (NA)	0	10 seconds continuous, Travel Forward Press. Sensor Measurement Voltage > 5.2V			●
	1	10 seconds continuous, 0.3V ≤ Travel Forward Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Travel Forward Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Travel Forward Press. display failure 2. Control Function – Driving interoperability power control operation failure (Checking list) 1. CD-73 (#B) – CN-54 (#6) Checking Open/Short 2. CD-73 (#A) – CN-54 (#3) Checking Open/Short 3. CD-73 (#C) – CN-54 (#13) Checking Open/Short				
531 (NA)	1	10 seconds continuous, 0.3V ≤ Travel Reverse Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Travel Reverse Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Travel Reverse Press. display failure 2. Control Function – Driving interoperability power control operation failure (Checking list) 1. CD-74 (#B) – CN-54 (#23) Checking Open/Short 2. CD-74 (#A) – CN-54 (#3) Checking Open/Short 3. CD-74 (#C) – CN-54 (#13) Checking Open/Short				
705	0	10 seconds continuous, Battery input Voltage > 35V	●		
	1	10 seconds continuous, Battery input Voltage < 18V	●		
	(Results / Symptoms) 1. Control Function – Startup impossibility (Checking list) 1. CS-74A (#1) – CN-51 (#1) Checking Open/Short				
707	1	(When Engine is equal or more than 400 rpm) 10 seconds continuous, Alternator Node I Measurement Voltage < 18V (In case 12v goods, Alternator Node I Measurement Voltage < 9V)	●		
	(Results / Symptoms) 1. Control Function – Battery charging circuit failure (Checking list) 1. CS-74A (#1) – CN-51 (#2) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General

C : Crawler Type

W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
714	3	(Model Parameter) Mounting Acc. Dial 10 seconds continuous, Acc. Dial Measurement Voltage > 5.2V	●		
	4	(Model Parameter) Mounting Acc. Dial 10 seconds continuous, Acc. Dial Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Acc. Dial Voltage display failure 2. Control Function – Engine rpm control failure (Checking list) 1. CN-142 (#B) – CN-52 (#23) Checking Open/Short				
722	4	(Detection) (When Travel Alarm (Buzzer) Sound is Off) 10 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Travel Alarm (Buzzer) Sound Relay is Off) 3 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Travel Alarm (Buzzer) Sound is On) 10 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive current > 4.5 A (Cancellation) (When Travel Alarm (Buzzer) Sound is On) 3 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive current ≤ 4.5 A	●		
	(Results / Symptoms) 1. Control Function – Driving alarm operation failure (Checking list) 1. CN-81 (#1) – CN-52 (#13) Checking Open/Short 2. CN-81 (#2) – Fuse box (#30) Checking Open/Short				
831 (N.A)	2	(When mounting the A/C Controller) 60 seconds continuous, A/C Controller Communication Data Error	●		
	(Results / Symptoms) 1. Control Function – A/C Controller operation failure (Checking list) 1. CN-11 (#8) – CN-51 (#22) Checking Open/Short 2. CN-11 (#7) – CN-51 (#32) Checking Open/Short				
840	2	60 seconds continuous, Cluster Communication Data Error	●		
	(Results / Symptoms) 1. Control Function – Cluster operation failure (Checking list) 1. CN-56A (#7) – CN-51 (#32) Checking Open/Short 2. CN-56A (#6) – CN-51 (#22) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General

C : Crawler Type

W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
841	2	10 seconds continuous, ECM Communication Data Error	●		
		(Results / Symptoms) 1. Control Function – ECM operation failure (Checking list) 1. CN-93 (#22) – CN-51 (#21) Checking Open/Short 2. CN-93 (#46) – CN-51 (#31) Checking Open/Short			
845 (NA)	2	(When mounting the I/O Controller 1) 60 seconds continuous, I/O Controller 1 Communication Data Error	●		
		(Results / Symptoms) 1. Control Function – I/O Controller 1 operation failure (Checking list) 1. CN-53 (#21) – CN-51 (#23) Checking Open/Short 2. CN-53 (#31) – CN-51 (#33) Checking Open/Short			
848 (NA)	2	(When mounting the Haptic Controller) 60 seconds continuous, Haptic Controller Communication Data Error	●		
		(Results / Symptoms) 1. Control Function – Haptic Controller operation failure (Checking list) 1. CN-8 (#2) – CN-51 (#22) Checking Open/Short 2. CN-8 (#3) – CN-51 (#32) Checking Open/Short			
850	2	(When mounting the RMCU) 60 seconds continuous, RMCU communication Data Error	●		
		(Results / Symptoms) 1. Control Function – RMCU operation failure (Checking list) 1. CN-125A (#3) – CN-51 (#22) Checking Open/Short 2. CN-125A (#11) – CN-51 (#32) Checking Open/Short			
861 (NA)	2	(When mounting the I/O Controller 2) 60 seconds continuous, I/O Controller 2 communication Data Error	●		
		(Results / Symptoms) 1. Control Function – I/O Controller 2 operation failure (Checking list) 1. CN-53 (#21) – CN-51 (#23) Checking Open/Short 2. CN-53 (#31) – CN-51 (#33) Checking Open/Short			

※ Some error codes are not applied to this machine.

G : General

C : Crawler Type

W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
866	2	(When mounting the AAVM) 60 seconds continuous, AAVM communication Data Error	●		
		(Results / Symptoms) 1. Control Function – AAVM operation failure (Checking list) 1. CN-401 (#15) – CN-51 (#22) Checking Open/Short 2. CN-401 (#3) – CN-51 (#32) Checking Open/Short			
867	2	60 seconds continuous, RDU communication Data Error	●		
		(Results / Symptoms) 1. Control Function – RDU operation failure (Checking list) 1. CN-376 (#10) – CN-51 (#22) Checking Open/Short 2. CN-376 (#18) – CN-51 (#32) Checking Open/Short			
868	2	60 seconds continuous, Switch Controller communication Data Error	●		
		(Results / Symptoms) 1. Control Function – Switch Controller operation failure (Checking list) 1. CN-56A (#7) – CN-51 (#32) Checking Open/Short 2. CN-56A (#6) – CN-51 (#22) Checking Open/Short			
869	2	(When mounting the BKCU) 60 seconds continuous, BKCU communication Data Error	●		
		(Results / Symptoms) 1. Control Function – BKCU operation failure (Checking list) 1. CS-2B (#A) – CN-51 (#22) Checking Open/Short 2. CS-2B (#B) – CN-51 (#32) Checking Open/Short			

※ Some error codes are not applied to this machine.

G : General

C : Crawler Type

W : Wheel Type

4. ENGINE FAULT CODE

Fault code	J1939 SPN	J1939 FMI	Item	Description
111	629	12	Controller #1	Engine Control Module Critical Internal Failure - Bad intelligent device or component
115	612	2	System Diagnostic Code #2	Engine Magnetic Speed/Position Lost Both of Two Signals - Data erratic, intermittent or incorrect
122	102	3	Engine Intake Manifold #1 Pressure	Intake Manifold 1 Pressure Sensor Circuit - Voltage above normal, or shorted to high source
123	102	4	Engine Intake Manifold #1 Pressure	Intake Manifold 1 Pressure Sensor Circuit - Voltage below normal, or shorted to low source
124	102	16	Engine Intake Manifold #1 Pressure	Intake Manifold 1 Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level
125	102	18	Engine Intake Manifold #1 Pressure	Intake Manifold 1 Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level
131	91	3	Accelerator Pedal Position 1	Accelerator Pedal or Lever Position Sensor 1 Circuit - Voltage above normal, or shorted to high source
132	91	4	Accelerator Pedal Position 1	Accelerator Pedal or Lever Position Sensor 1 Circuit - Voltage below normal, or shorted to low source
133	974	3	Remote Accelerator Pedal Position	Remote Accelerator Pedal or Lever Position Sensor 1 Circuit - Voltage above normal, or shorted to high source
134	974	4	Remote Accelerator Pedal Position	Remote Accelerator Pedal or Lever Position Sensor 1 Circuit - Voltage below normal, or shorted to low source
135	100	3	Engine Oil Pressure 1	Engine Oil Rifle Pressure 1 Sensor Circuit - Voltage above normal, or shorted to high source
141	100	4	Engine Oil Pressure 1	Engine Oil Rifle Pressure 1 Sensor Circuit - Voltage below normal, or shorted to low source
143	100	18	Engine Oil Pressure 1	Engine Oil Rifle Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level
144	110	3	Engine Coolant Temperature	Engine Coolant Temperature 1 Sensor Circuit - Voltage above normal, or shorted to high source
145	110	4	Engine Coolant Temperature	Engine Coolant Temperature 1 Sensor Circuit - Voltage below normal, or shorted to low source
146	110	16	Engine Coolant Temperature	Engine Coolant Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level
147	91	1	Accelerator Pedal Position 1	Accelerator Pedal or Lever Position 1 Sensor Circuit Frequency - Data valid but below normal operating Range
148	91	0	Accelerator Pedal Position 1	Accelerator Pedal or Lever Position Sensor 1 - Data valid but above normal operational range - Most Severe Level
151	110	0	Engine Coolant Temperature	Engine Coolant Temperature - Data valid but above normal operational range - Most Severe Level
153	105	3	Engine Intake Manifold 1 Temperature	Intake Manifold 1 Temperature Sensor Circuit - Voltage above normal, or shorted to high source
154	105	4	Engine Intake Manifold 1 Temperature	Intake Manifold 1 Temperature Sensor Circuit - Voltage below normal, or shorted to low source

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
155	105	0	Engine Intake Manifold 1 Temperature	Intake Manifold 1 Temperature - Data valid but above normal operational range - Most Severe Level
187	3510	4	Sensor supply voltage 2	Sensor Supply 2 Circuit - Voltage below normal, or shorted to low source
193	520199	3	Cruise Control	Cruise Control (Resistive) Signal Circuit - Voltage above normal, or shorted to high source
194	520199	4	Cruise Control	Cruise Control (Resistive) Signal Circuit - Voltage below normal, or shorted to low source
195	111	3	Engine Coolant Level 1	Coolant Level Sensor 1 Circuit - Voltage above normal, or shorted to high source
196	111	4	Engine Coolant Level 1	Coolant Level Sensor 1 Circuit - Voltage below normal, or shorted to low source
197	111	18	Engine Coolant Level 1	Coolant Level - Data Valid But Below Normal Operating Range - Moderately Severe Level
212	175	3	Engine Oil Temperature 1	Engine Oil Temperature Sensor 1 Circuit - Voltage above normal, or shorted to high source
213	175	4	Engine Oil Temperature 1	Engine Oil Temperature Sensor 1 Circuit - Voltage below normal, or shorted to low source
214	175	0	Engine Oil Temperature 1	Engine Oil Temperature - Data valid but above normal operational range - Most Severe Level
221	108	3	Barometric Pressure	Barometric Pressure Sensor Circuit - Voltage above normal, or shorted to high source
222	108	4	Barometric Pressure	Barometric Pressure Sensor Circuit - Voltage above normal, or shorted to low source
227	3510	3	Sensor supply voltage 2	Sensor Supply 2 Circuit - Voltage above normal, or shorted to high source
228	109	1	Engine Coolant Pressure 1	Coolant Pressure - Data Valid But Below Normal Operating Range - Most Severe Level
231	109	3	Engine Coolant Pressure 1	Coolant Pressure Sensor Circuit - Voltage above normal, or shorted to high source
232	109	4	Engine Coolant Pressure 1	Coolant Pressure Sensor Circuit - Voltage below normal, or shorted to low source
233	109	18	Engine Coolant Pressure 1	Coolant Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level
234	190	0	Engine Speed	Engine Crankshaft Speed/Position - Data valid but above normal operational range - Most Severe Level
235	111	1	Engine Coolant Level 1	Coolant Level - Data valid but below normal operational range - Most Severe Level
237	644	2	Engine External Speed Command Input	External Speed Command Input (Multiple Unit Synchronization) - Data erratic, intermittent or incorrect
238	3511	4	Sensor supply voltage 3	Sensor Supply 3 Circuit - Voltage below normal, or shorted to low source
239	3511	3	Sensor supply voltage 3	Sensor Supply 3 Circuit - Voltage above normal, or shorted to high source

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
241	84	2	Wheel-Based Vehicle Speed	Wheel-Based Vehicle Speed - Data erratic, intermittent or incorrect
242	84	10	Wheel-Based Vehicle Speed	Wheel-Based Vehicle Speed Sensor Circuit tampering has been detected - Abnormal rate of change
245	647	4	Engine Fan Clutch 1 Output Driver	Fan Control Circuit - Voltage below normal, or shorted to low source
249	171	3	Ambient Air Temperature	Ambient Air Temperature Sensor 1 Circuit - Voltage above normal, or shorted to high source
256	171	4	Ambient Air Temperature	Ambient Air Temperature Sensor 1 Circuit - Voltage below normal, or shorted to low source
261	174	16	Engine Fuel 1 Temperature 1	Engine Fuel Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level
263	174	3	Engine Fuel 1 Temperature 1	Engine Fuel Temperature Sensor 1 Circuit - Voltage above normal, or shorted to high source
265	174	4	Engine Fuel 1 Temperature 1	Engine Fuel Temperature Sensor 1 Circuit - Voltage below normal, or shorted to low source
266	174	0	Engine Fuel 1 Temperature 1	Engine Fuel Temperature - Data valid but above normal operational range - Most Severe Level
269	1195	2	Anti-theft Password Valid Indicator	Antitheft Password Valid Indicator - Data erratic, intermittent or incorrect
271	1347	4	Engine Fuel Pump Pressurizing Assembly #1	Engine Fuel Pump Pressurizing Assembly 1 Circuit - Voltage below normal, or shorted to low source
272	1347	3	Engine Fuel Pump Pressurizing Assembly #1	Engine Fuel Pump Pressurizing Assembly 1 Circuit - Voltage above normal, or shorted to high source
281	1347	7	Engine Fuel Pump Pressurizing Assembly #1	Engine Fuel Pump Pressurizing Assembly 1 - Mechanical system not responding or out of adjustment
285	639	9	J1939 Network #1, Primary Vehicle Network	SAE J1939 Multiplexing PGN Timeout Error - Abnormal update rate
286	639	13	J1939 Network #1, Primary Vehicle Network	SAE J1939 Multiplexing Configuration Error - Out of Calibration
288	974	19	Remote Accelerator Pedal Position	SAE J1939 Multiplexing Remote Accelerator Pedal or Lever Position Sensor System - Received Network Data In Error
291	625	9	Proprietary Network #1	Proprietary Datalink Error (OEM/Vehicle Datalink) - Abnormal update rate
292	441	14	Auxiliary Temperature 1	Auxiliary Temperature Sensor Input 1 - Special Instructions
293	441	3	Auxiliary Temperature 1	Auxiliary Temperature Sensor Input 1 Circuit - Voltage above normal, or shorted to high source
294	441	4	Auxiliary Temperature 1	Auxiliary Temperature Sensor Input 1 Circuit - Voltage below normal, or shorted to low source
295	108	2	Barometric Pressure	Barometric Pressure - Data erratic, intermittent or incorrect
296	1388	14	Auxiliary Pressure #2	Auxiliary Pressure Sensor Input 2 - Special Instructions
297	1388	3	Auxiliary Pressure #2	Auxiliary Pressure Sensor Input 2 Circuit - Voltage above normal, or shorted to high source

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
298	1388	4	Auxiliary Pressure #2	Auxiliary Pressure Sensor Input 2 Circuit - Voltage below normal, or shorted to low source
319	251	2	Time	Real Time Clock - Data erratic, intermittent or incorrect
322	651	5	Engine Fuel 1 Injector Cylinder 1	Injector Solenoid Driver Cylinder 1 Circuit - Current below normal or open circuit
323	655	5	Engine Fuel 1 Injector Cylinder 5	Injector Solenoid Driver Cylinder 5 Circuit - Current below normal or open circuit
324	653	5	Engine Fuel 1 Injector Cylinder 3	Injector Solenoid Driver Cylinder 3 Circuit - Current below normal or open circuit
325	656	5	Engine Fuel 1 Injector Cylinder 6	Injector Solenoid Driver Cylinder 6 Circuit - Current below normal or open circuit
331	652	5	Engine Fuel 1 Injector Cylinder 2	Injector Solenoid Driver Cylinder 2 Circuit - Current below normal or open circuit
332	654	5	Engine Fuel 1 Injector Cylinder 4	Injector Solenoid Driver Cylinder 4 Circuit - Current below normal or open circuit
334	110	2	Engine Coolant Temperature	Engine Coolant Temperature - Data erratic, intermittent or incorrect
338	1267	3	Idle Shutdown Vehicle Accessories Relay Driver Circuit	Idle Shutdown Vehicle Accessories Relay Driver Circuit - Voltage above normal, or shorted to high source
339	1267	4	Idle Shutdown Vehicle Accessories Relay Driver Circuit	Idle Shutdown Vehicle Accessories Relay Driver Circuit - Voltage below normal, or shorted to low source
343	629	12	Controller #1	Engine Control Module Warning Internal Hardware Failure - Bad intelligent device or component
346	630	12	Calibration Memory	Engine Control Module Calibration Memory Software - Bad Intelligent Device or Component
349	191	16	Transmission 1 Output Shaft Speed	Transmission Output Shaft Speed - Data Valid But Above Normal Operating Range - Moderately Severe Level
351	3597	12	ECU Power Output Supply Voltage #1	Injector Power Supply - Bad intelligent device or component
352	3509	4	Sensor supply voltage 1	Sensor Supply 1 Circuit - Voltage below normal, or shorted to low source
386	3509	3	Sensor supply voltage 1	Sensor Supply 1 Circuit - Voltage above normal, or shorted to high source
415	100	1	Engine Oil Pressure 1	Engine Oil Rifle Pressure - Data valid but below normal operational range - Most Severe Level
418	97	15	Water In Fuel Indicator 1	Water in Fuel Indicator - Data Valid But Above Normal Operating Range - Least Severe Level
421	175	16	Engine Oil Temperature 1	Engine Oil Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level
422	111	2	Engine Coolant Level 1	Coolant Level - Data erratic, intermittent or incorrect
425	175	2	Engine Oil Temperature 1	Engine Oil Temperature - Data erratic, intermittent or incorrect
428	97	3	Water In Fuel Indicator 1	Water in Fuel Indicator Sensor Circuit - Voltage above normal, or shorted to high source

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
429	97	4	Water In Fuel Indicator 1	Water in Fuel Indicator Sensor Circuit - Voltage below normal, or shorted to low source
431	558	2	Accelerator Pedal 1 Low Idle Switch	Accelerator Pedal or Lever Idle Validation Switch - Data erratic, intermittent or incorrect
432	558	13	Accelerator Pedal 1 Low Idle Switch	Accelerator Pedal or Lever Idle Validation Switch Circuit - Out of Calibration
435	100	2	Engine Oil Pressure 1	Engine Oil Rifle Pressure - Data erratic, intermittent or incorrect
436	105	2	Engine Intake Manifold 1 Temperature	Intake Manifold 1 Temperature - Data erratic, intermittent or incorrect
441	168	18	Battery Potential / Power Input 1	Battery 1 Voltage - Data Valid But Below Normal Operating Range - Moderately Severe Level
442	168	16	Battery Potential / Power Input 1	Battery 1 Voltage - Data Valid But Above Normal Operating Range - Moderately Severe Level
449	157	0	Engine Fuel 1 Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure - Data valid but above normal operational range - Most Severe Level
451	157	3	Engine Fuel 1 Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure Sensor Circuit - Voltage above normal, or shorted to high source
452	157	4	Engine Fuel 1 Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure Sensor Circuit - Voltage below normal, or shorted to low source
483	1349	3	Engine Fuel 1 Injector Metering Rail 2 Pressure	Injector Metering Rail 2 Pressure Sensor Circuit - Voltage above normal, or shorted to high source
484	1349	4	Engine Fuel 1 Injector Metering Rail 2 Pressure	Injector Metering Rail 2 Pressure Sensor Circuit - Voltage below normal, or shorted to low source
487	626	18	Engine Start Enable Device 1	Start Enable Device 1 Canister Empty (Ether Injection) - Data Valid But Below Normal Operating Range
488	105	16	Engine Intake Manifold 1 Temperature	Intake Manifold 1 Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level
489	191	18	Transmission 1 Output Shaft Speed	Transmission Output Shaft Speed - Data Valid But Below Normal Operating Range - Moderately Severe Level
497	1377	2	Engine Synchronization Switch	Multiple Unit Synchronization Switch - Data erratic, intermittent or incorrect
515	3514	3	Sensor supply voltage 6	Sensor Supply 6 Circuit - Voltage above normal, or shorted to high source
516	3514	4	Sensor supply voltage 6	Sensor Supply 6 Circuit - Voltage below normal, or shorted to low source
523	611	2	System Diagnostic Code #1	Auxiliary Intermediate (PTO) Speed Switch Validation - Data erratic, intermittent or incorrect
527	702	3	Auxiliary I/O #02	Auxiliary Input/Output 2 Circuit - Voltage above normal, or shorted to high source
528	93	2	Engine Net Brake Torque	Auxiliary Alternate Torque Validation Switch - Data erratic, intermittent or incorrect
529	703	3	Auxiliary I/O #03	Auxiliary Input/Output 3 Circuit - Voltage above normal, or shorted to high source

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
535	174	2	Engine Fuel 1 Temperature 1	Engine Fuel Temperature - Data erratic, intermittent or incorrect
546	94	3	Engine Fuel Delivery Pressure	Fuel Delivery Pressure Sensor Circuit - Voltage above normal, or shorted to high source
547	94	4	Engine Fuel Delivery Pressure	Fuel Delivery Pressure Sensor Circuit - Voltage below normal, or shorted to low source
553	157	16	Engine Fuel 1 Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level
555	101	16	Engine Crankcase Pressure 1	Crankcase Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level
556	101	0	Engine Crankcase Pressure 1	Crankcase Pressure - Data valid but above normal operational range - Most Severe Level
559	157	18	Engine Fuel 1 Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level
584	677	3	Engine Starter Motor Relay	Starter Relay Driver Circuit - Voltage above normal, or shorted to high source
585	677	4	Engine Starter Motor Relay	Starter Relay Driver Circuit - Voltage below normal, or shorted to low source
595	103	16	Engine Turbocharger 1 Speed	Turbocharger 1 Speed - Data Valid But Above Normal Operating Range - Moderately Severe Level
599	640	14	Engine External Protection Input	Auxiliary Commanded Dual Output Shutdown - Special Instructions
611	1383	31	Engine was Shut Down Hot	Engine Shut Down Hot - Condition Exists
629	1176	18	Engine Turbocharger 1 Compressor Intake Pressure	Turbocharger 1 Compressor Intake Pressure - Data Valid But Below Normal Operating Range - Moderately
649	1378	31	Engine Oil Change Interval	Engine Oil Change Interval - Condition Exists
687	103	18	Engine Turbocharger 1 Speed	Turbocharger 1 Speed - Data Valid But Below Normal Operating Range - Moderately Severe Level
689	190	2	Engine Speed	Engine Crankshaft Speed/Position - Data erratic, intermittent or incorrect
691	1172	3	Engine Turbocharger 1 Compressor Intake Temperature	Turbocharger 1 Compressor Intake Temperature Circuit - Voltage above normal, or shorted to high source
692	1172	4	Engine Turbocharger 1 Compressor Intake Temperature	Turbocharger 1 Compressor Intake Temperature Circuit - Voltage below normal, or shorted to low source
693	1172	2	Engine Turbocharger 1 Compressor Intake Temperature	Turbocharger 1 Compressor Intake Temperature - Data erratic, intermittent or incorrect
696	1173	2	Engine Turbocharger 2 Compressor Intake Temperature	Turbocharger 2 Compressor Intake Temperature - Data Erratic, Intermittent, or Incorrect
697	1136	3	Engine ECU Temperature	Engine ECU Temperature Sensor Circuit - Voltage above normal, or shorted to high source
698	1136	4	Engine ECU Temperature	Engine ECU Temperature Sensor Circuit - Voltage below normal, or shorted to low source

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
699	1136	2	Engine ECU Temperature	Engine ECU Temperature - Data erratic, intermittent or incorrect
731	723	7	Engine Speed 2	Engine Speed / Position Camshaft and Crankshaft Misalignment - Mechanical system not responding or out of adjustment
741	1176	3	Engine Turbocharger 1 Compressor Intake Pressure	Turbocharger 1 Compressor Intake Pressure Circuit - Voltage above normal, or shorted to high source
742	1176	4	Engine Turbocharger 1 Compressor Intake Pressure	Turbocharger 1 Compressor Intake Pressure Circuit - Voltage below normal, or shorted to low source
743	1176	2	Engine Turbocharger 1 Compressor Intake Pressure	Turbocharger 1 Compressor Intake Pressure - Data erratic, intermittent or incorrect
755	157	7	Engine Fuel 1 Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure - Mechanical system not responding or out of adjustment
769	597	3	Brake Switch	Brake Switch Circuit - Voltage above normal, or shorted to high source
771	597	4	Brake Switch	Brake Switch Circuit - Voltage below normal, or shorted to low source
778	723	2	Engine Speed 2	Engine Camshaft Speed / Position Sensor - Data erratic, intermittent or incorrect
784	1590	2	Adaptive Cruise Control Mode	Adaptive Cruise Control Mode - Data erratic, intermittent or incorrect
1117	3597	2	ECU Power Output Supply Voltage #1	Power Supply Lost With Ignition On - Data erratic, intermittent or incorrect
1139	651	7	Engine Fuel 1 Injector Cylinder 1	Injector Solenoid Driver Cylinder 1 - Mechanical system not responding or out of adjustment
1141	652	7	Engine Fuel 1 Injector Cylinder 2	Injector Solenoid Driver Cylinder 2 - Mechanical system not responding or out of adjustment
1142	653	7	Engine Fuel 1 Injector Cylinder 3	Injector Solenoid Driver Cylinder 3 - Mechanical system not responding or out of adjustment
1143	654	7	Engine Fuel 1 Injector Cylinder 4	Injector Solenoid Driver Cylinder 4 - Mechanical system not responding or out of adjustment
1144	655	7	Engine Fuel 1 Injector Cylinder 5	Injector Solenoid Driver Cylinder 5 - Mechanical system not responding or out of adjustment
1145	656	7	Engine Fuel 1 Injector Cylinder 6	Injector Solenoid Driver Cylinder 6 - Mechanical system not responding or out of adjustment
1239	2623	3	Accelerator Pedal #1 Channel 2	Accelerator Pedal or Lever Position Sensor 2 Circuit - Voltage above normal, or shorted to high source
1241	2623	4	Accelerator Pedal #1 Channel 2	Accelerator Pedal or Lever Position Sensor 2 Circuit - Voltage below normal, or shorted to low source
1242	91	2	Accelerator Pedal Position 1	Accelerator Pedal or Lever Position Sensor 1 - Data erratic, intermittent or incorrect
1256	1563	2	Incompatible Monitor/Controller	Control Module Identification Input State Error - Data erratic, intermittent or incorrect
1257	1563	2	Incompatible Monitor/Controller	Control Module Identification Input State Error - Data erratic, intermittent or incorrect
1358	91	3	Accelerator Pedal Position 1	Accelerator Pedal or Lever Position Sensor 1 Circuit - Voltage above normal, or shorted to high source
1359	91	4	Accelerator Pedal Position 1	Accelerator Pedal or Lever Position Sensor 1 Circuit - Voltage below normal, or shorted to low source

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
1427	4185	31	Overspeed Shutdown Relay Driver	Overspeed Shutdown Relay Driver Diagnostic has detected an error - Condition Exists
1428	4186	31	Low Oil Pressure Shutdown Relay Driver	Low Oil Pressure (LOP) Shutdown Relay Driver Diagnostic has detected an error - Condition Exists
1429	4187	31	High Engine Temperature Shutdown Relay Driver	High Engine Temperature (HET) Shutdown Relay Driver Diagnostic has detected an error - Condition Exists
1431	4188	31	Pre-Low Oil Pressure Indicator Relay Driver	Pre-Low Oil Pressure Warning Relay Driver Diagnostic has detected an error - Condition Exists
1432	4223	31	Pre-High Engine Temperature Warning Relay Driver	Pre-High Engine Temperature Warning Relay Driver Diagnostic has detected an error - Condition Exists
1433	611	31	System Diagnostic Code #1	Operator Interface Mode Transition to Emergency Stop (Due to E-Stop) - Condition Exists
1515	91	19	Accelerator Pedal Position 1	SAE J1939 Multiplexed Accelerator Pedal or Lever Sensor System - Received Network Data In Error
1539	1387	3	Auxiliary Pressure #1	Auxiliary Pressure Sensor Input 1 Circuit - Voltage above normal, or shorted to high source
1621	1387	4	Auxiliary Pressure #1	Auxiliary Pressure Sensor Input 1 Circuit - Voltage below normal, or shorted to low source
1654	1323	31	Engine Cylinder 1 Misfire Rate	Engine Misfire Cylinder 1 - Condition Exists
1655	1324	31	Engine Cylinder 2 Misfire Rate	Engine Misfire Cylinder 2 - Condition Exists
1656	1325	31	Engine Cylinder 3 Misfire Rate	Engine Misfire Cylinder 3 - Condition Exists
1657	1326	31	Engine Cylinder 4 Misfire Rate	Engine Misfire Cylinder 4 - Condition Exists
1658	1327	31	Engine Cylinder 5 Misfire Rate	Engine Misfire Cylinder 5 - Condition Exists
1659	1328	31	Engine Cylinder 6 Misfire Rate	Engine Misfire Cylinder 6 - Condition Exists
1695	3513	3	Sensor supply voltage 5	Sensor Supply 5 - Voltage above normal, or shorted to high source
1696	3513	4	Sensor supply voltage 5	Sensor Supply 5 - Voltage below normal, or shorted to low source
1718	1322	31	Engine Misfire for Multiple Cylinders	Engine Misfire for Multiple Cylinders - Condition Exists
1776	2634	3	Power Relay	Power Relay Driver Circuit - Voltage above normal, or shorted to high source
1777	2634	4	Power Relay	Power Relay Driver Circuit - Voltage below normal, or shorted to low source
1843	101	3	Engine Crankcase Pressure 1	Crankcase Pressure Circuit - Voltage above normal, or shorted to high source
1844	101	4	Engine Crankcase Pressure 1	Crankcase Pressure Circuit - Voltage below normal, or shorted to low source
1847	110	14	Engine Coolant Temperature	Engine Coolant Temperature - Special Instructions
1852	97	16	Water In Fuel Indicator 1	Water in Fuel Indicator - Data Valid But Above Normal Operating Range - Moderately Severe Level
1894	641	9	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Driver Circuit - Abnormal update rate
1898	641	13	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Controller - Out of Calibration

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
1938	3597	18	ECU Power Output Supply Voltage #1	ECU Power Output Supply Voltage 1 - Data Valid But Below Normal Operating Range - Moderately Severe Level
1939	3597	3	ECU Power Output Supply Voltage #1	ECU Power Output Supply Voltage 1 - Voltage above normal, or shorted to high source
1941	3597	4	ECU Power Output Supply Voltage #1	ECU Power Output Supply Voltage 1 - Voltage below normal, or shorted to low source
1942	101	2	Engine Crankcase Pressure 1	Crankcase Pressure - Data erratic, intermittent or incorrect
1943	3555	17	Ambient Air Density	Ambient Air Density - Data Valid But Below Normal Operating Range - Least Severe Level
1974	101	15	Engine Crankcase Pressure 1	Crankcase Pressure - Data Valid But Above Normal Operating Range - Least Severe Level
1976	641	15	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Driver Over Temperature (Calculated) - Data Valid But Above Normal Operating Range - Least Severe Level
2185	3512	3	Sensor supply voltage 4	Sensor Supply 4 Circuit - Voltage above normal, or shorted to high source
2186	3512	4	Sensor supply voltage 4	Sensor Supply 4 Circuit - Voltage below normal, or shorted to low source
2191	102	31	Engine Intake Manifold #1 Pressure	Intake Manifold 1 Pressure Sensor - Condition Exists
2198	641	11	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Driver Circuit - Root Cause Not Known
2215	94	18	Engine Fuel Delivery Pressure	Fuel Pump Delivery Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level
2249	157	1	Engine Fuel 1 Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure - Data valid but below normal operational range - Most Severe Level
2261	94	15	Engine Fuel Delivery Pressure	Fuel Pump Delivery Pressure - Data Valid But Above Normal Operating Range - Least Severe Level
2262	94	17	Engine Fuel Delivery Pressure	Fuel Pump Delivery Pressure - Data Valid But Below Normal Operating Range - Least Severe Level
2265	1075	3	Engine Electric Lift Pump	Electric Lift Pump for Engine Fuel Supply Circuit - Voltage above normal, or shorted to high source
2266	1075	4	Engine Electric Lift Pump	Electric Lift Pump for Engine Fuel Supply Circuit - Voltage below normal, or shorted to low source
2288	103	15	Engine Turbocharger 1 Speed	Turbocharger 1 Speed - Data Valid But Above Normal Operating Range - Least Severe Level
2292	611	16	System Diagnostic Code #1	Fuel Inlet Meter Device - Data Valid But Above Normal Operating Range - Moderately Severe Level
2293	611	18	System Diagnostic Code #1	Fuel Inlet Meter Device flow demand lower than expected - Data Valid But Below Normal Operating Range - Moderately Severe Level
2311	633	31	Engine Fuel Actuator 1 Control Command	Electronic Fuel Injection Control Valve Circuit - Condition Exists

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
2321	190	2	Engine Speed	Engine Crankshaft Speed/Position - Data erratic, intermittent or incorrect
2322	723	2	Engine Speed 2	Engine Camshaft Speed / Position Sensor - Data erratic, intermittent or incorrect
2346	2789	15	Engine Turbocharger 1 Calculated Turbine Intake Temperature	Turbocharger Turbine Intake Temperature - Data Valid But Above Normal Operating Range - Least Severe
2347	2629	15	Engine Turbocharger 1 Compressor Outlet Temperature	Turbocharger Compressor Outlet Temperature (Calculated) - Data Valid But Above Normal Operating Range
2372	95	16	Engine Fuel Filter Differential Pressure	Fuel Filter Differential Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level
2373	1209	3	Engine Exhaust Pressure 1	Exhaust Gas Pressure Sensor 1 Circuit - Voltage above normal, or shorted to high source
2374	1209	4	Engine Exhaust Pressure 1	Exhaust Gas Pressure Sensor 1 Circuit - Voltage below normal, or shorted to low source
2377	647	3	Engine Fan Clutch 1 Output Driver	Fan Control Circuit - Voltage above normal, or shorted to high source
2387	641	7	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Driver Circuit (Motor) - Mechanical system not responding or out of adjustment
2398	171	2	Ambient Air Temperature	Ambient Air Temperature - Data erratic, intermittent or incorrect
2448	111	17	Engine Coolant Level 1	Coolant Level - Data Valid But Below Normal Operating Range - Least Severe Level
2451	2789	16	Engine Turbocharger 1 Calculated Turbine Intake Temperature	Turbocharger Turbine Intake Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level
2468	190	16	Engine Speed	Engine Crankshaft Speed/Position - Data Valid But Above Normal Operating Range - Moderately Severe Level
2554	1209	2	Engine Exhaust Pressure 1	Exhaust Gas Pressure 1 - Data erratic, intermittent or incorrect
2555	729	3	Engine Intake Air Heater Driver #1	Engine Intake Air Heater 1 Circuit - Voltage above normal, or shorted to high source
2556	729	4	Engine Intake Air Heater Driver #1	Engine Intake Air Heater 1 Circuit - Voltage below normal, or shorted to low source
2557	697	3	Auxiliary PWM Driver #1	Auxiliary PWM Driver 1 Circuit - Voltage above normal, or shorted to high source
2558	697	4	Auxiliary PWM Driver #1	Auxiliary PWM Driver 1 Circuit - Voltage below normal, or shorted to low source
2571	2630	3	Engine Charge Air Cooler 1 Outlet Temperature	Engine Charge Air Cooler Outlet Temperature - Voltage above normal, or shorted to high source
2572	2630	4	Engine Charge Air Cooler 1 Outlet Temperature	Engine Charge Air Cooler Outlet Temperature - Voltage below normal, or shorted to low source
2634	641	12	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Controller - Bad intelligent device or component

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
2635	641	31	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Driver Circuit - Condition Exists
2636	641	9	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Driver Circuit - Abnormal update rate
2646	110	31	Engine Coolant Temperature	Engine Coolant Temperature - Condition Exists
2659	110	31	Engine Coolant Temperature	Engine Coolant Temperature - Condition Exists
2661	629	31	Controller #1	At Least One Unacknowledged Most Severe Fault - Condition Exists
2662	629	31	Controller #1	At Least One Unacknowledged Moderately Severe Fault - Condition Exists
2699	520320	7	Crankcase Depression Valve	Crankcase Depression Valve - Mechanical system not responding or out of adjustment
2738	626	3	Engine Start Enable Device 1	Start Enable Device 1 Circuit (Ether Injection) - Voltage above normal, or shorted to high source
2739	626	4	Engine Start Enable Device 1	Start Enable Device 1 Circuit (Ether Injection) - Voltage below normal, or shorted to low source
2764	1209	16	Engine Exhaust Pressure 1	Exhaust Gas Pressure 1 - Data Valid But Above Normal Operating Range - Moderately Severe Level
2765	2797	13	Engine Fuel 1 Injector Group 1	Engine Injector Bank 1 Barcodes - Out of Calibration
2777	3703	31	Diesel Particulate Filter Active Regeneration Inhibited Due to Inhibit Switch	Particulate Trap Active Regeneration Inhibited Due to Inhibit Switch - Condition Exists
2789	110	18	Engine Coolant Temperature	Engine Coolant Temperature - Data Valid But Below Normal Operating Range - Moderately Severe Level
2963	110	15	Engine Coolant Temperature	Engine Coolant Temperature - Data Valid But Above Normal Operating Range - Least Severe Level
2964	105	15	Engine Intake Manifold 1 Temperature	Intake Manifold 1 Temperature - Data Valid But Above Normal Operating Range - Least Severe Level
2973	102	2	Engine Intake Manifold #1 Pressure	Intake Manifold 1 Pressure - Data erratic, intermittent or incorrect
2998	1632	14	Engine Torque Limit Feature	Engine Torque Limit Feature - Special Instructions
3131	190	14	Engine Speed	Engine Crankshaft Speed/Position - Special Instructions
3139	3667	3	Engine Air Shutoff Status	Engine Air Shutoff Circuit - Voltage above normal, or shorted to high source
3141	3667	4	Engine Air Shutoff Status	Engine Air Shutoff Circuit - Voltage below normal, or shorted to low source
3186	1623	9	Tachograph output shaft speed	Tachograph Output Shaft Speed - Abnormal update rate
3213	1623	19	Tachograph output shaft speed	Tachograph Output Shaft Speed - Received Network Data In Error
3222	520435	12	Glow Plug Module	Glow Plug Module - Bad intelligent device or component
3243	3060	18	Engine Cooling System Monitor	Engine Cooling System Monitor - Data Valid But Below Normal Operating Range - Moderately Severe Level

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
3298	1194	13	Anti-theft Encryption Seed Present Indicator	Anti-theft Encryption Seed - Out of Calibration
3326	91	9	Accelerator Pedal Position 1	SAE J1939 Multiplexed Accelerator Pedal or Lever Sensor System - Abnormal update rate
3328	191	9	Transmission 1 Output Shaft Speed	Transmission Output Shaft Speed - Abnormal update rate
3329	1231	2	J1939 Network #2	J1939 Network #2 - Data erratic, intermittent or incorrect
3331	1235	2	J1939 Network #3	J1939 Network #3 - Data erratic, intermittent or incorrect
3337	5395	16	Engine Idle Fuel Quantity	Engine Idle Fuel Quantity - Data Valid But Above Normal Operating Range - Moderately Severe Level
3338	5395	18	Engine Idle Fuel Quantity	Engine Idle Fuel Quantity - Data Valid But Below Normal Operating Range - Moderately Severe Level
3341	107	16	Engine Air Filter 1 Differential Pressure	Engine Air Filter Differential Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level
3348	1176	1	Engine Turbocharger 1 Compressor Intake Pressure	Turbocharger 1 Compressor Intake Pressure - Data valid but below normal operational range - Most Severe Level
3361	102	10	Engine Intake Manifold #1 Pressure	Intake Manifold 1 Pressure - Abnormal rate of change
3366	111	18	Engine Coolant Level 1	Coolant Level - Data Valid But Below Normal Operating Range - Moderately Severe Level
3367	4490	9	Specific Humidity	Specific Humidity Sensor - Abnormal update rate
3368	4490	19	Specific Humidity	Specific Humidity Sensor - Received Network Data In Error
3369	1172	9	Engine Turbocharger 1 Compressor Intake Temperature	Turbocharger 1 Compressor Intake Temperature Sensor - Abnormal update rate
3371	1172	19	Engine Turbocharger 1 Compressor Intake Temperature	Turbocharger 1 Compressor Intake Temperature Sensor - Received Network Data In Error
3372	1176	9	Engine Turbocharger 1 Compressor Intake Pressure	Turbocharger 1 Compressor Intake Pressure - Abnormal update rate
3373	1176	19	Engine Turbocharger 1 Compressor Intake Pressure	Turbocharger 1 Compressor Intake Pressure - Received Network Data In Error
3374	1818	31	ROP Brake Control active	Roll Over Protection Brake Control Active - Condition Exists
3377	5396	31	Engine Crankcase Ventilation Hose Disconnected	Engine Crankcase Ventilation Hose Disconnected - Condition Exists
3385	105	18	Engine Intake Manifold 1 Temperature	Intake Manifold 1 Temperature - Data Valid But Below Normal Operating Range - Moderately Severe Level
3418	191	19	Transmission 1 Output Shaft Speed	Transmission Output Shaft Speed - Received Network Data In Error
3419	5125	3	Sensor supply voltage 7	Sensor Supply 7 Circuit - Voltage above normal, or shorted to high source
3421	5125	4	Sensor supply voltage 7	Sensor Supply 7 Circuit - Voltage below normal, or shorted to low source

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
3478	2630	2	Engine Charge Air Cooler 1 Outlet Temperature	Engine Charge Air Cooler Outlet Temperature - Data erratic, intermittent or incorrect
3488	563	9	Anti-Lock Braking (ABS) Active	Anti-Lock Braking (ABS) Controller - Abnormal update rate
3494	1081	7	Engine Wait to Start Lamp	Engine Wait to Start Lamp - Mechanical system not responding or out of adjustment
3525	84	19	Wheel-Based Vehicle Speed	Wheel-Based Vehicle Speed - Received Network Data In Error
3526	84	9	Wheel-Based Vehicle Speed	Wheel-Based Vehicle Speed - Abnormal update rate
3527	558	19	Accelerator Pedal 1 Low Idle Switch	Accelerator Pedal or Lever Idle Validation Switch - Received Network Data In Error
3528	558	9	Accelerator Pedal 1 Low Idle Switch	Accelerator Pedal or Lever Idle Validation Switch - Abnormal update rate
3531	171	9	Ambient Air Temperature	Ambient Air Temperature - Abnormal update rate
3532	171	19	Ambient Air Temperature	Ambient Air Temperature - Received Network Data In Error
3535	1213	9	Malfunction Indicator Lamp	Malfunction Indicator Lamp - Abnormal update rate
3555	1081	9	Engine Wait to Start Lamp	Engine Wait to Start Lamp - Abnormal update rate
3556	1081	19	Engine Wait to Start Lamp	Engine Wait to Start Lamp - Received Network Data In Error
3613	111	9	Engine Coolant Level 1	Coolant Level Sensor - Abnormal Update Rate
3614	111	19	Engine Coolant Level 1	Coolant Level Sensor - Received Network Data in Error
3616	2633	7	Engine Fan Clutch 2 Output Driver	Engine VGT Nozzle Position - Mechanical system not responding or out of adjustment
3633	5484	3	Engine Fan Clutch 2 Output Driver	Engine Fan Clutch 2 Control Circuit - Voltage above normal, or shorted to high source
3634	5484	4	Engine Fan Clutch 2 Output Driver	Engine Fan Clutch 2 Control Circuit - Voltage below normal, or shorted to low source
3641	748	9	Engine Exhaust 1 Gas Sensor 1 Power In Range	Transmission Output Retarder - Abnormal update rate
3683	1127	7	Engine Turbocharger 1 Boost Pressure	Engine Turbocharger 1 Boost Pressure - Mechanical system not responding or out of adjustment
3697	630	12	Calibration Memory	Engine Control Module Calibration Memory - Bad intelligent device or component
3714	1569	31	Engine Protection Torque Derate	Engine Protection Torque Derate - Condition Exists
3715	188	16	Engine Speed At Idle, Point 1	Engine Speed At Idle - Data Valid But Above Normal Operating Range - Moderately Severe Level
3716	188	18	Engine Speed At Idle, Point 1	Engine Speed At Idle - Data Valid But Below Normal Operating Range - Moderately Severe Level
3724	168	17	Battery Potential / Power Input 1	Battery 1 Voltage - Data Valid But Below Normal Operating Range - Least Severe Level
3727	5571	7	High Pressure Common Rail Fuel Pressure Relief Valve	High Pressure Common Rail Fuel Pressure Relief Valve - Mechanical system not responding or out of adjustment

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
3733	862	3	Heater Circuit #09	Crankcase Breather Filter Heater Circuit - Voltage above normal, or shorted to high source
3734	862	4	Heater Circuit #09	Crankcase Breather Filter Heater Circuit - Voltage below normal, or shorted to low source
3735	2884	9	Engine Auxiliary Governor Switch	Engine Auxiliary Governor Switch - Abnormal update rate
3737	1675	31	Engine Starter Mode	Engine Starter Mode Overcrank Protection - Condition Exists
3741	5571	0	High Pressure Common Rail Fuel Pressure Relief Valve	High Pressure Common Rail Fuel Pressure Relief Valve - Data valid but above normal operational range
3765	442	3	Auxiliary Temperature 2	Auxiliary Temperature Sensor Input 2 Circuit - Voltage above normal, or shorted to high source
3766	442	4	Auxiliary Temperature 2	Auxiliary Temperature Sensor Input 2 Circuit - Voltage below normal, or shorted to low source
3838	2978	9	Estimated Engine Parasitic Losses - Percent Torque	Estimated Engine Parasitic Losses - Percent Torque - Abnormal update rate
3841	596	2	Cruise Control Enable Switch	Cruise Control Enable Switch - Data erratic, intermittent or incorrect
3843	5603	9	Cruise Control Disable Command	Cruise Control Disable Command - Abnormal update rate
3844	5605	31	Cruise Control Pause Command	Cruise Control Pause Command - Condition Exists
3845	5603	31	Cruise Control Disable Command	Cruise Control Disable Command - Condition Exists
3917	104	18	Engine Turbocharger Lube Oil Pressure 1	Engine Turbocharger Lube Oil Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level
4215	563	31	Anti-Lock Braking (ABS) Active	Anti-Lock Braking (ABS) Active - Condition Exists
4252	1081	31	Engine Wait to Start Lamp	Engine Wait to Start Lamp - Condition Exists
4262	5571	3	High Pressure Common Rail Fuel Pressure Relief Valve	High Pressure Common Rail Fuel Pressure Relief Valve - Voltage Above Normal, or Shorted to High Source
4263	5571	4	High Pressure Common Rail Fuel Pressure Relief Valve	High Pressure Common Rail Fuel Pressure Relief Valve - Voltage below normal, or shorted to low source
4265	5571	11	High Pressure Common Rail Fuel Pressure Relief Valve	High Pressure Common Rail Fuel Pressure Relief Valve - Root Cause Not Known
4284	5793	9	Desired Engine Fueling State	Desired Engine Fueling State - Abnormal Update Rate
4286	520595	3	Closed Crankcase Ventilation System Pressure Sensor	Closed Crankcase Ventilation System Pressure Sensor - Voltage Above Normal, or Shorted to High Source
4287	520595	4	Closed Crankcase Ventilation System Pressure Sensor	Closed Crankcase Ventilation System Pressure Sensor - Voltage below normal, or shorted to low source
4288	520595	2	Closed Crankcase Ventilation System Pressure	Closed Crankcase Ventilation System Pressure - Data erratic, intermittent or incorrect
4437	1668	2	J1939 Network #4	J1939 Network #4 - Data erratic, intermittent or incorrect

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
4484	3667	7	Engine Air Shutoff Status	Engine Air Shutoff - Mechanical System Not Responding or Out of Adjustment
4517	237	13	Vehicle Identification Number	Vehicle Identification Number - Out of Calibration
4526	521	2	Brake Pedal Position	Brake Pedal Position - Data erratic, intermittent or incorrect
4615	94	0	Engine Fuel Delivery Pressure	Engine Fuel Delivery Pressure - Data Valid but Above Normal Operational Range - Most Severe Level
4642	97	0	Water In Fuel Indicator 1	Water in Fuel Indicator - Data Valid But Above Normal Operating Range - Most Severe Level
4688	6301	3	Water in Fuel Indicator 2	Water in Fuel Indicator 2 Sensor Circuit - Voltage above normal, or shorted to high source
4689	6301	4	Water in Fuel Indicator 2	Water in Fuel Indicator 2 Sensor Circuit - Voltage below normal, or shorted to low source
4691	5585	18	Engine Fuel 1 Injector Metering Rail 1 Cranking Pressure	Engine Injector Metering Rail 1 Cranking Pressure - Data Valid But Below Normal Operating Range - Mo
4713	5357	31	Engine Fuel Injection Quantity Error for Multiple Cylinders	Engine Fuel Injection Quantity Error for Multiple Cylinders - Condition Exists
4721	237	31	Vehicle Identification Number	Vehicle Identification Number - Condition Exists
4722	237	2	Vehicle Identification Number	Vehicle Identification Number - Data erratic, intermittent or incorrect
4724	702	5	Auxiliary I/O #02	Auxiliary Input/Output 2 Circuit - Current below normal or open circuit
4725	702	6	Auxiliary I/O #02	Auxiliary Input/Output 2 Circuit - Current above normal or grounded circuit
4726	1239	16	Engine Fuel Leakage 1	Engine Fuel Leakage - Data Valid But Above Normal Operating Range - Moderately Severe Level
4727	157	15	Engine Fuel 1 Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure - Data Valid But Above Normal Operating Range - Least Severe Level
4734	701	14	Auxiliary I/O #01	Auxiliary Input/Output 1 - Special Instructions
4789	1639	0	Fan Speed	Fan Speed - Data Valid but Above Normal Operational Range - Most Severe Level
4791	1639	1	Fan Speed	Fan Speed - Data Valid but Below Normal Operational Range - Most Severe Level
4839	3667	31	Engine Air Shutoff Status	Engine Air Shutoff - Condition Exists
4841	6653	16	Engine Fuel 1 Injector Metering Rail 1 Cold Start Pressure	Cold Start Injector Metering Rail 1 Pressure - Data Valid But Above Normal Operating Range - Moderate Severe Level
4867	5571	31	High Pressure Common Rail Fuel Pressure Relief Valve	High Pressure Common Rail Fuel Pressure Relief Valve - Condition Exists
4927	7026	12	Engine Diesel Fuel Metering Valve	Engine Diesel Fuel Metering Valve - Bad Intelligent Device or Component
4928	7027	2	Engine Diesel Fuel Metering Valve Power Supply	Engine Diesel Fuel Metering Valve Power Supply - Data Erratic, Intermittent, or Incorrect
4929	7027	3	Engine Diesel Fuel Metering Valve Power Supply	Engine Diesel Fuel Metering Valve Power Supply - Voltage Above Normal or Shorted to High Source

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
4931	7027	4	Engine Diesel Fuel Metering Valve Power Supply	Engine Diesel Fuel Metering Valve Power Supply - Voltage Below Normal or Shorted to Low Source
4933	7029	19	Engine Diesel Fuel Metering Valve Position	Engine Diesel Fuel Metering Valve Position - Received Network Data in Error
4934	7026	3	Engine Diesel Fuel Metering Valve	Engine Diesel Fuel Metering Valve - Voltage Above Normal or Shorted to High Source
4935	7026	4	Engine Diesel Fuel Metering Valve	Engine Diesel Fuel Metering Valve - Voltage Below Normal or Shorted to Low Source
4936	5380	11	Engine Fuel Valve 1 Preliminary FMI	Engine Fuel Valve 1 - Root Cause Not Known
4937	5380	13	Engine Fuel Valve 1 Preliminary FMI	Engine Fuel Valve 1 - Out of Calibration
4951	6655	3	Maintain ECU Power Lamp	Maintain ECU Power Lamp - Voltage Above Normal, or Shorted to High Source
4952	6655	4	Maintain ECU Power Lamp	Maintain ECU Power Lamp - Voltage Below Normal, or Shorted to Low Source
4953	3353	3	Alternator 1 Status	Alternator 1 Status - Voltage Above Normal, or Shorted to High Source
4954	3353	4	Alternator 1 Status	Alternator 1 Status - Voltage Below Normal, or Shorted to Low Source
4956	6713	13	Engine Variable Geometry Turbocharger Actuator Software Identification	Variable Geometry Turbocharger Actuator Software - Out of Calibration
4957	6713	31	Engine Variable Geometry Turbocharger Actuator Software Identification	Variable Geometry Turbocharger Actuator Software - Condition Exists
4958	7026	2	Engine Diesel Fuel Metering Valve	Engine Diesel Fuel Metering Valve - Data Erratic, Intermittent, or Incorrect
4959	7026	31	Engine Diesel Fuel Metering Valve	Engine Diesel Fuel Metering Valve - Condition Exists
4961	7026	9	Engine Diesel Fuel Metering Valve	Engine Diesel Fuel Metering Valve - Abnormal Update Rate
5122	520754	2	Manufacturer Assignable SPN	Fuel Pump Oil Pressure Sensor Circuit - Data Erratic, Intermittent, or Incorrect
5133	2006	9	Source Address 6	Source Address 6 - Abnormal Update Rate
5167	111	17	Engine Coolant Level 1	Coolant Level - Data Valid But Below Normal Operating Range - Least Severe Level
5173	2900	19	Transmission Engine Crank Enable	Transmission Engine Crank Enable - Received Network Data in Error
5174	2900	9	Transmission Engine Crank Enable	Transmission Engine Crank Enable - Abnormal Update Rate
5177	6713	9	Engine Variable Geometry Turbocharger Actuator Software Identification	VGT Actuator Driver Circuit - Abnormal update rate
5183	6799	3	Engine Fan Blade Pitch	Fan Blade Pitch Position Sensor Circuit - Voltage Above Normal, or Shorted to High Source
5184	6799	4	Engine Fan Blade Pitch	Fan Blade Pitch Position Sensor Circuit - Voltage Below Normal, or Shorted to Low Source

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
5185	6799	7	Engine Fan Blade Pitch	Fan Blade Pitch - Mechanical system not responding or out of adjustment
5193	1632	31	Engine Torque Limit Feature	Engine Torque Limit Feature - Condition Exists
5215	520791	2	Engine Boost Curve Selection	Engine Boost Curve Selection - Data erratic, intermittent or incorrect
5221	3667	2	Engine Air Shutoff Status	Engine Air Shutoff Status - Data erratic, intermittent or incorrect
5248	1623	13	Tachograph Output Shaft Speed	Tachograph Output Shaft Speed - Out of Calibration
5273	649	5	Engine Exhaust Bank 1 Pressure Regulator Control Command	Engine Exhaust Back Pressure Regulator Control Circuit - Current Below Normal or Open Circuit
5274	5625	2	Engine Exhaust Bank 1 Pressure Regulator Position	Engine Exhaust Back Pressure Regulator Position - Data Erratic, Intermittent or Incorrect
5276	5625	4	Engine Exhaust Bank 1 Pressure Regulator Position	Engine Exhaust Back Pressure Regulator Position Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
5277	5626	13	Engine Exhaust Pressure Regulator Preliminary FMI	Engine Exhaust Back Pressure Regulator - Out of Calibration
5291	520808	31	Engine Emergency Shutdown Switch Activated	Engine Emergency Shutdown Switch Activated - Condition Exists
5292	520809	31	Excessive Time Since Last Engine Air Shutoff Maintenance Test	Excessive Time Since Last Engine Air Shutoff Maintenance Test - Condition Exists
5315	2629	16	Engine Turbocharger 1 Compressor Outlet Temperature	Turbocharger Compressor Outlet Temperature (Calculated) - Data Valid But Above Normal Operating Range - Moderately Severe Level
5316	2789	0	Engine Turbocharger 1 Calculated Turbine Intake Temperature	Turbocharger Turbine Intake Temperature - Data Valid But Above Normal Operating Range - Most Severe Level
5366	6301	16	Water in Fuel Indicator 2	Water in Fuel Indicator 2 - Data Valid But Above Normal Operating Range - Moderately Severe Level
5367	6301	0	Water in Fuel Indicator 2	Water in Fuel Indicator 2 - Data Valid But Above Normal Operating Range - Most Severe Level
5384	5502	16	Engine Unburned Fuel Percentage	Relative Unburned Fuel Mass - Data Valid But Above Normal Operating Range - Moderately Severe Level
5385	5502	0	Engine Unburned Fuel Percentage	Relative Unburned Fuel Mass - Data Valid But Above Normal Operating Range - Most Severe Level
5576	107	15	Engine Air Filter 1 Differential Pressure	Engine Air Filter Differential Pressure - Data Valid But Above Normal Operating Range - Least Severe Level
5585	5571	15	High Pressure Common Rail Fuel Pressure Relief Valve	High Pressure Common Rail Fuel Pressure Relief Valve - Data Valid But Above Normal Operating Range - Least Severe Level
5588	5607	7	Cruise Control System Command State	Cruise Control System Command State - Mechanical System Not Responding or Out of Adjustment
5622	1632	31	Engine Torque Limit Feature	Engine Torque Limit Feature - Condition Exists

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
5652	1209	15	Engine Exhaust Pressure 1	Exhaust Pressure 1 - Data Valid But Above Normal Operating Range - Least Severe Level
5862	7029	3	Engine Diesel Fuel Metering Valve Position	Engine Diesel Fuel Metering Valve Position Sensor Circuit - Voltage Above Normal or Shorted to High Source
5863	7029	4	Engine Diesel Fuel Metering Valve Position	Engine Diesel Fuel Metering Valve Position Sensor Circuit - Voltage Below Normal or Shorted to Low Source
5866	520953	3	Manufacturer Assignable SPN	Aftertreatment Diesel Exhaust Fluid Dosing Unit Relay Feedback- Voltage Above Normal or Shorted to High Source.
5867	520953	4	Manufacturer Assignable SPN	Aftertreatment Diesel Exhaust Fluid Dosing Unit Relay Feedback- Voltage Below Normal or Shorted to Low Source.
5939	520968	9	Manufacturer Assignable SPN	Machine Constrained Operation- Abnormal Update Rate. No Communication or an invalid data transfer rate has been detected on the J1939 data link between the ECM and the machine electronic control unit.
5941	520968	19	Manufacturer Assignable SPN	Machine Constrained Operation- Received Network Data in Error. The received J1939 datalink message was not valid.
6256	168	15	Battery Potential / Power Input 1	Battery 1 Voltage - Data Valid But Above Normal Operating Range - Least Severe Level
6257	168	17	Battery Potential / Power Input 1	Battery 1 Voltage - Data Valid But Below Normal Operating Range - Moderately Severe Level
6258	1075	3	Engine Electric Lift Pump	Electric Lift Pump for Engine Fuel Supply Circuit - Voltage above normal, or shorted to high source
6259	1075	4	Engine Electric Lift Pump	Electric Lift Pump for Engine Fuel Supply Circuit - Voltage below normal, or shorted to low source
6263	647	3	Engine Fan Clutch 1 Output Driver	Fan Control Circuit - Voltage above normal, or shorted to high source
6264	647	4	Engine Fan Clutch 1 Output Driver	Fan Control Circuit - Voltage below normal, or shorted to low source
6336	862	3	Heater Circuit #09	Crankcase Breather Filter Heater Circuit - Voltage above normal, or shorted to high source
6337	862	4	Heater Circuit #09	Crankcase Breather Filter Heater Circuit - Voltage below normal, or shorted to low source
6456	5484	3	Engine Fan Clutch 2 Output Driver	Engine Fan Clutch 2 Control Circuit - Voltage above normal, or shorted to high source
6457	5484	4	Engine Fan Clutch 2 Output Driver	Engine Fan Clutch 2 Control Circuit - Voltage below normal, or shorted to low source
6467	1639	15	Fan Speed	Fan Speed - Data Valid but Above Normal Operational Range - Least Severe Level
6468	1639	17	Fan Speed	Fan Speed - Data Valid but Below Normal Operational Range - Most Severe Level
6469	1639	2	Fan Speed	Fan Speed – Data Erratic, Intermittent, or Incorrect
6471	6799	3	Engine Fan Blade Pitch	Fan Blade Pitch Position Sensor Circuit - Voltage Above Normal, or Shorted to High Source

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
6472	6799	4	Engine Fan Blade Pitch	Fan Blade Pitch Position Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
6473	6799	2	Engine Fan Blade Pitch	Fan Blade Pitch – Data Erratic, Intermittent, or Incorrect
6493	3464	3	Engine Throttle Actuator 1 Control Command	Electronic Throttle Control Actuator Driver Circuit- Voltage above normal, or shorted to high source
6494	3464	4	Engine Throttle Actuator 1 Control Command	Electronic Throttle Control Actuator Driver Circuit- Voltage above normal, or shorted to low source
6496	3464	5	Engine Throttle Actuator 1 Control Command	Electronic Throttle Control Actuator Driver Circuit- Current Below Normal or Open Circuit
6497	51	3	Engine Throttle Valve 1 Position 1	Engine Intake Throttle Actuator Position Sensor Circuit- Voltage above normal, or shorted to high source
6498	51	4	Engine Throttle Valve 1 Position 1	Engine Intake Throttle Actuator Position Sensor Circuit- Voltage above normal, or shorted to low source
6499	3597	17	ECU Power Output Supply Voltage #1	ECU Power Output Supply Voltage 1 - Data Valid But Below Normal Operating Range - Moderately Severe Level
6511	6655	3	Maintain ECU Power Lamp	Maintain ECU Power Lamp - Voltage Above Normal, or Shorted to High Source
6512	6655	4	Maintain ECU Power Lamp	Maintain ECU Power Lamp - Voltage Below Normal, or Shorted to Low Source
6522	111	3	Engine Coolant Level 1	Coolant Level Sensor 1 Circuit - Voltage above normal, or shorted to high source
6523	111	4	Engine Coolant Level 1	Coolant Level Sensor 1 Circuit - Voltage below normal, or shorted to low source
6524	175	3	Engine Oil Temperature 1	Engine Oil Temperature Sensor 1 Circuit - Voltage above normal, or shorted to high source
6525	175	4	Engine Oil Temperature 1	Engine Oil Temperature Sensor 1 Circuit - Voltage below normal, or shorted to low source
6563	976	2	PTO Governor State	Auxiliary Intermediate (PTO) Speed Switch Validation - Data erratic, intermittent or incorrect
6573	7028	16	Engine Diesel Fuel Metering Valve Temperature	Engine Diesel Fuel Metering Valve Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level
6574	7028	0	Engine Diesel Fuel Metering Valve Temperature	Engine Diesel Fuel Metering Valve Temperature - Data Valid But Above Normal Operating Range - Most Severe Level
6583	441	14	Auxiliary Temperature 1	Auxiliary Temperature Sensor Input 1 - Special Instructions
6584	1388	14	Auxiliary Pressure #2	Auxiliary Pressure Sensor Input 2 - Special Instructions
6599	521002	31	Manufacturer Assignable SPN	Engine Cranks Slowly - Condition Exists
6611	6385	3	Engine Starter Motor Relay Control	Engine Starter Motor Relay Control Circuit - Voltage Above Normal or Shorted to High Source
6612	6385	4	Engine Starter Motor Relay Control	Engine Starter Motor Relay Control Circuit - Voltage Below Normal or Shorted to Low Source

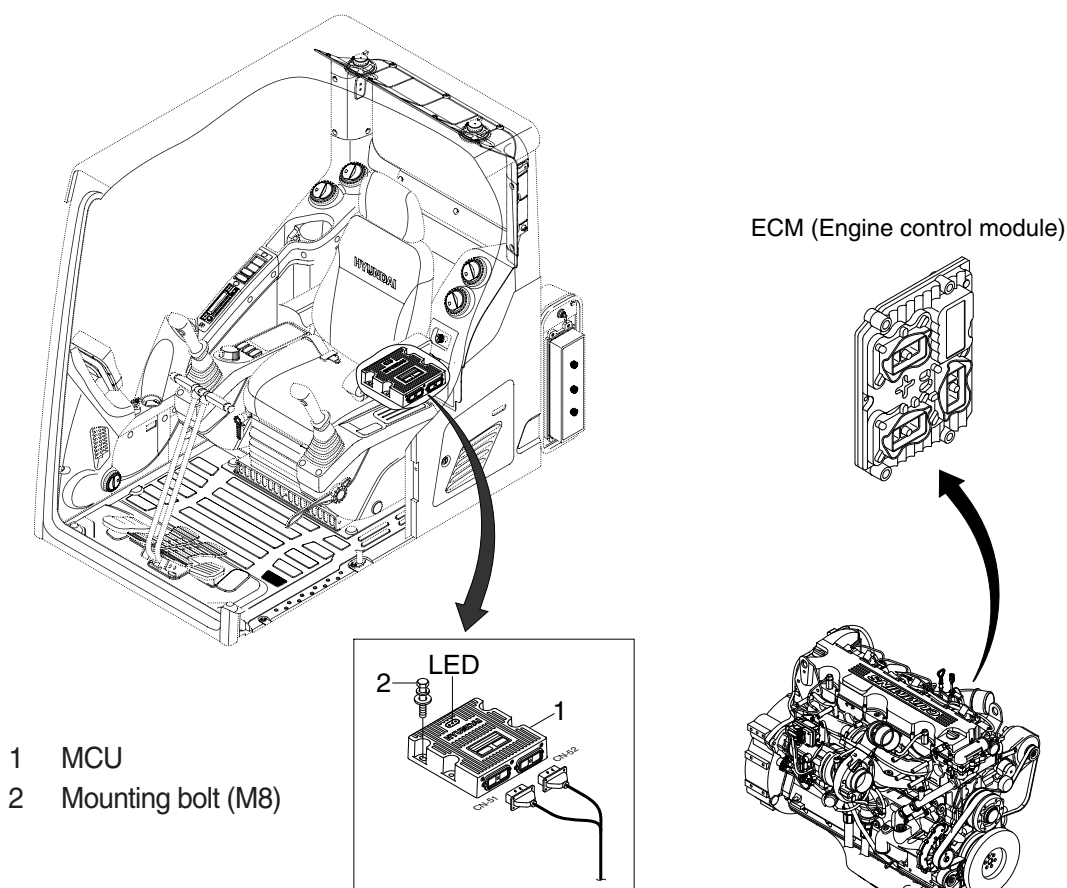
※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
6614	6806	31	ECU 1 Interface Mismatch	ECM 1 Data Link Interface Mismatch - Condition Exists
6618	70	2	Parking Brake Switch	Parking Brake Switch - Data Erratic, Intermittent, or Incorrect
6819	651	7	Engine Fuel 1 Injector Cylinder 1	Injector Solenoid Driver Cylinder 1 - Mechanical System Not Responding or Out of Adjustment
6821	652	7	Engine Fuel 1 Injector Cylinder 2	Injector Solenoid Driver Cylinder 2 - Mechanical System Not Responding or Out of Adjustment
6822	653	7	Engine Fuel 1 Injector Cylinder 3	Injector Solenoid Driver Cylinder 3 - Mechanical System Not Responding or Out of Adjustment
6823	654	7	Engine Fuel 1 Injector Cylinder 4	Injector Solenoid Driver Cylinder 4 - Mechanical System Not Responding or Out of Adjustment
6824	655	7	Engine Fuel 1 Injector Cylinder 5	Injector Solenoid Driver Cylinder 5 - Mechanical System Not Responding or Out of Adjustment
6825	656	7	Engine Fuel 1 Injector Cylinder 6	Injector Solenoid Driver Cylinder 6 - Mechanical System Not Responding or Out of Adjustment
6938	5793	9	Desired Engine Fueling State	Desired Engine Fueling State - Abnormal Update Rate
6939	7745	9	Engine Start Request	Engine Start Request - Abnormal Update Rate
7133	7745	13	Engine Start Request	Engine Start Request - Out of Calibration
7134	7746	13	Engine Start Consent	Engine Start Consent - Out of Calibration
7285	1569	14	Engine Protection Torque Derate	Engine Protection Torque Derate - Special Instructions
7385	524286	31	Manufacturer Assignable SPN	Engine Start Abort Request - Out of Calibration
7393	524286	31	Manufacturer Assignable SPN	Engine Start Request - Abnormal Update Rate
7394	524286	31	Manufacturer Assignable SPN	Engine Shutdown Command - Out of Calibration
7395	524286	31	Manufacturer Assignable SPN	Engine Shutdown Command - Abnormal Update Rate
9491	524286	31	Manufacturer Assignable SPN	Reserved for temporary use - Condition Exists
9799	524286	31	Manufacturer Assignable SPN	Reserved for temporary use - Condition Exists
9999	524286	31	Manufacturer Assignable SPN	Reserved for temporary use - Condition Exists

※ Some fault codes are not applied to this machine.

GROUP 13 ENGINE CONTROL SYSTEM

1. MCU (Machine Control Unit)



2. MCU ASSEMBLY

1) To match the pump absorption torque with the engine torque, MCU varies EPPR valve output pressure, which control pump discharge amount whenever feedbacked engine speed drops under the reference rpm of each mode set.

2) Three LED lamps on the MCU display as below.

LED lamp	Trouble	Service
G is turned ON	Normal	-
G and R are turned ON	Trouble on MCU	· Change the MCU
G and Y are turned ON	Trouble on serial communication line	· Check if serial communication lines between MCU and cluster are disconnected
Three LED are turned OFF	Trouble on MCU power	· Check if the input power wire (24 V, GND) of MCU is disconnected · Check the fuse

G : green, R : red, Y : yellow

GROUP 14 EPPR VALVE

1. PUMP EPPR VALVE

1) COMPOSITION

EPPR (Electro Proportional Pressure Reducing) valve consists of electro magnet and spool valve installed at main pump.

(1) Electro magnet valve

Receive electric current from MCU and move the spool proportionally according to the specific amount of electric current value.

(2) Spool valve

Is the two way direction control valve for pilot pressure to reduce main pump flow.

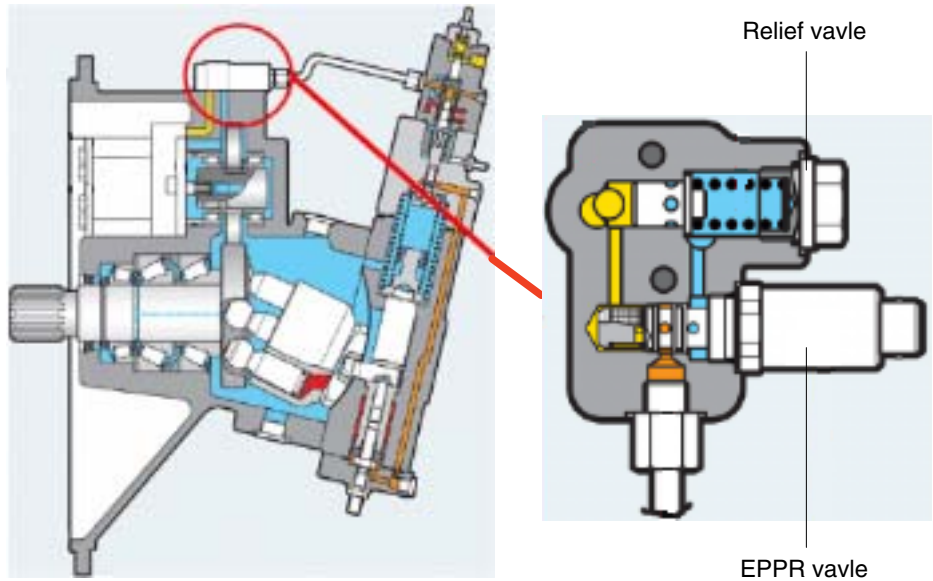
When the electro magnet valve is activated, pilot pressure enters into flow regulator of main pump.

(3) Pressure and electric current value for each mode

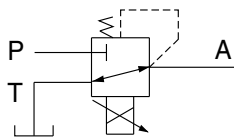
Power mode		Engine rpm		Pressure (Pf)		
		No load	Load	No load	Load	
				-	Boom up full stroke & pump no relief	Boom up full stroke & pump relief
Standard	P	1700	1800	8.5	8~5	8
	S	1600	1700	9	8.5~5.5	8.5
	E	1500	1600	9	8.5~5.5	8.5
Option	P	1800	1800	5	5	5
	S	1700	1700	5.5	5.5	5.5
	E	1600	1600	5.5	5.5	5.5

2) OPERATING PRINCIPLE (pump EPPR valve)

(1) Structure



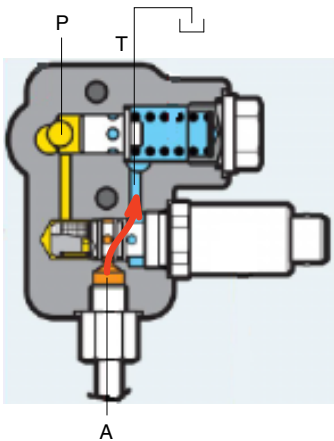
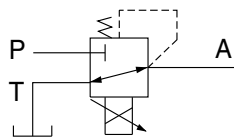
480A5MP15



- P Pilot oil supply line (pilot pressure)
- T Return to tank
- A Negative control pressure to main pump

(2) Neutral

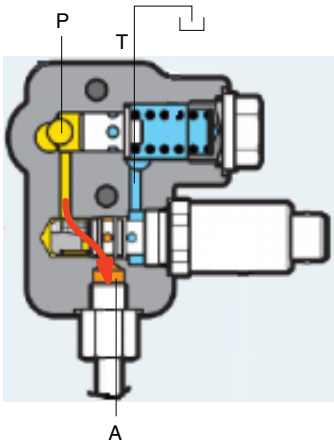
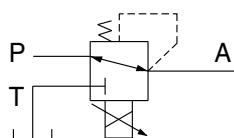
Pressure line is blocked and A oil returns to tank.



480A5MP16

(3) Operating

Negative control pressure enters into A.

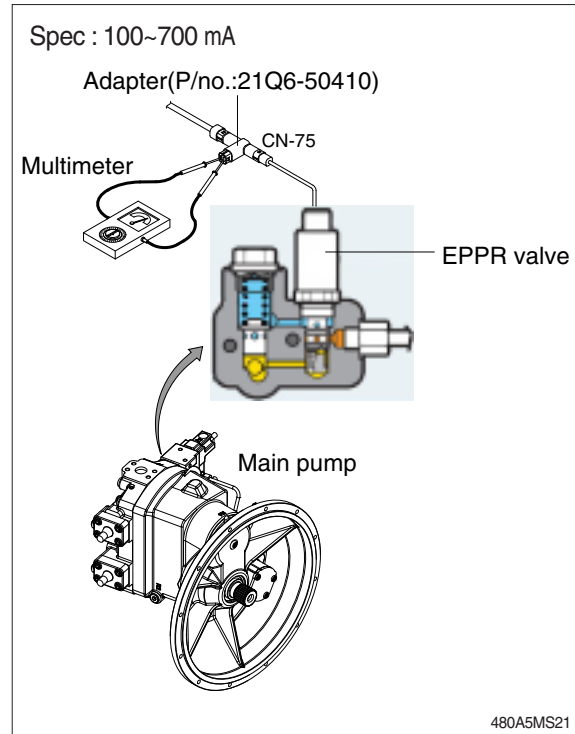


480A5MP17

3) EPPR VALVE CHECK PROCEDURE

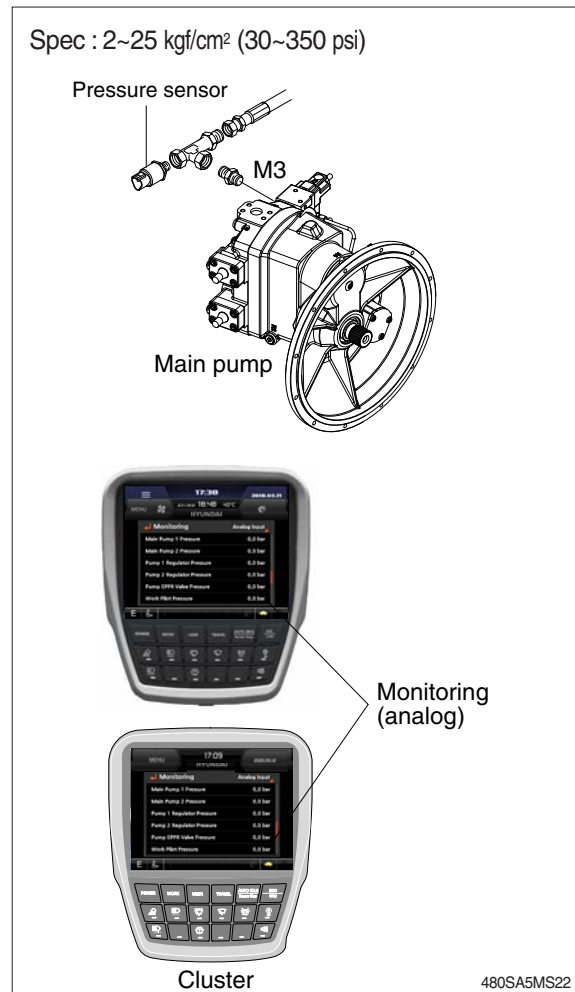
(1) Check electric current value at EPPR valve

- ① Disconnect connector CN-75 from EPPR valve.
- ② Insert the adapter to CN-75 and install multimeter as figure.
- ③ Start engine.
- ④ Set S-mode and cancel auto decel mode.
- ⑤ Position the accel dial at 10.
- ⑥ If rpm display show approx 1600 ± 50 rpm check electric current at bucket circuit relief position.
- ⑦ Check electric current at bucket circuit relief position.



(2) Check pressure at EPPR valve

- ① Start engine.
- ② Set S-mode and cancel auto decel mode.
- ③ Position the accel dial at 10.
- ④ If tachometer show approx 1600 ± 50 rpm check pressure at relief position of bucket circuit by operating bucket control lever.
- ⑤ If pressure is not correct, adjust it.
- ⑥ After adjust, test the machine.



GROUP 15 MONITORING SYSTEM

1. OUTLINE

Monitoring system consists of the monitor part and switch part.

The monitor part gives warnings when any abnormality occurs in the machine and informs the condition of the machine.

Various select switches are built into the monitor panel, which act as the control portion of the machine control system.

2. CLUSTER

1) MONITOR PANEL

Normal type



480SA3CD50A

Premium type



480SA3CD51A

※ The warning lamp pops up and/or blinks and the buzzer sounds when the machine has a problem. The warning lamp blinks until the problem is cleared. Refer to page 5-60 for details.

2) CLUSTER CHECK PROCEDURE

(1) Start key : ON

① Check monitor

- a. Buzzer sounding for 4 seconds with HYUNDAI logo on cluster.
- ※ If the ESL mode is set to the enable, enter the password to start engine.

② After initialization of cluster, the operating screen is displayed on the LCD.

Also, self diagnostic function is carried out.

- a. Engine rpm display : 0 rpm
- b. Engine coolant temperature gauge : White range
- c. Hydraulic oil temperature gauge : White range
- d. Fuel level gauge : White range

③ Indicating lamp state

- a. Power mode pilot lamp : E mode or U mode
- b. Work mode pilot lamp : General operation mode (bucket)
- c. Travel speed pilot lamp : Low (turtle)

(2) Start of engine

① Check machine condition

- a. RPM display indicates at present rpm
- b. Gauge and warning lamp : Indicate at present condition.
- ※ When normal condition : All warning lamp OFF
- c. Work mode selection : General work
- d. Power mode selection : E mode or U mode
- e. Travel speed pilot lamp : Low (turtle)

② When warming up operation

- a. Warming up pilot lamp : ON
- b. After engine started, engine speed increases to 1400 rpm.
- ※ Others same as above.

③ When abnormal condition

- a. The warning lamp lights up and the buzzer sounds.
- b. If BUZZER STOP switch is pressed, buzzer sound is canceled but the lamp warning lights up until normal condition.
- ※ The pop-up warning lamp moves to the original position and blink when the buzzer stop switch is pushed. Also the buzzer stops.

3. CLUSTER CONNECTOR

1) NORMAL TYPE

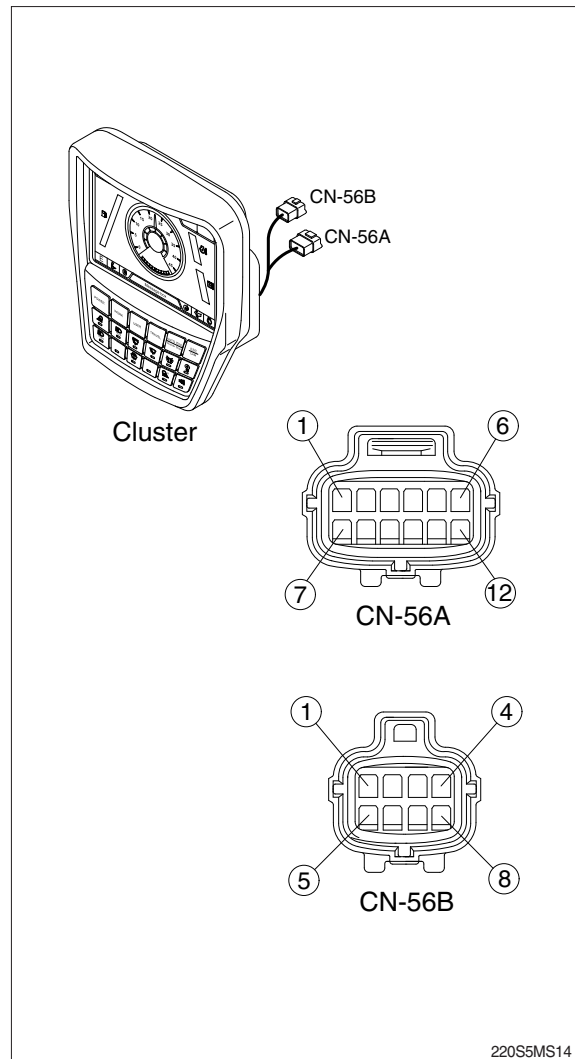
(1) CN-56A

No.	Name	Signal
1	Battery 24V	20~32Vdc
2	Power IG {24V}	20~32Vdc
3	GND	-
4	N.C	-
5	N.C	-
6	CAN 2 (H)	0~5Vdc
7	CAN 2 (L)	20~32Vdc
8	N.C	-
9	N.C	-
10	N.C	-
11	N.C	-
12	N.C	-

(2) CN-56B

No.	Name	Signal
1	CAM + 6.5V	6.3~6.7Vdc
2	CAM GND	-
3	CAM DIFF (H)	0~5Vdc
4	CAM DIFF (L)	0~5Vdc
5	CAM 1	NTSC signal
6	CAM 2	NTSC signal
7	CAM 3	NTSC signal
8	CAM shield	0~5Vdc

NTSC : National Television System Committee



2) PREMIUM TYPE

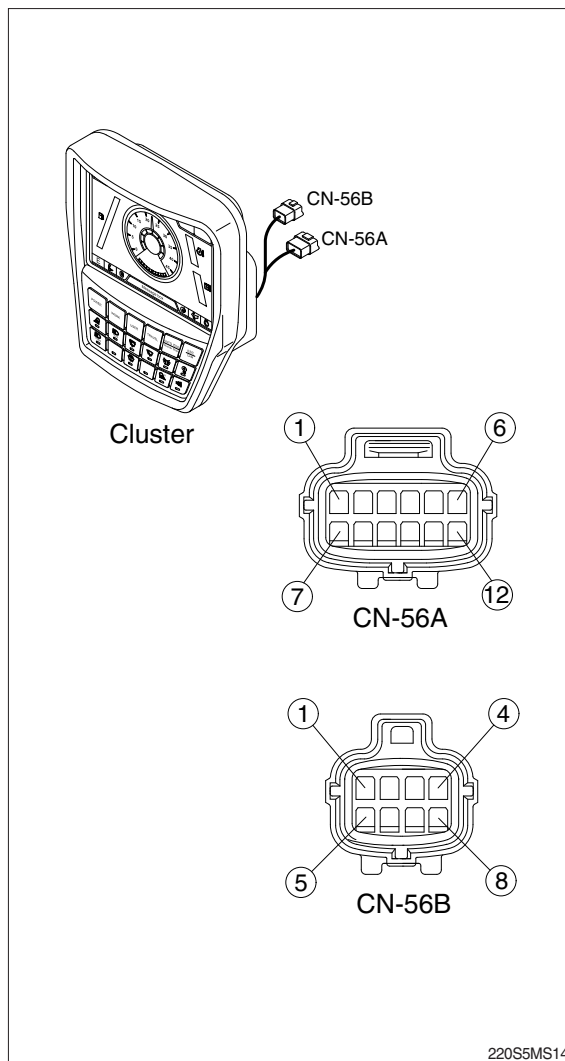
(1) CN-56A

No.	Name	Signal
1	Battery 24V	20~32Vdc
2	Power IG {24V}	20~32Vdc
3	GND	-
4	N.C	-
5	N.C	-
6	CAN 2 (H)	0~5Vdc
7	CAN 2 (L)	20~32Vdc
8	N.C	-
9	N.C	-
10	N.C	-
11	N.C	-
12	N.C	-

(2) CN-56B

No.	Name	Signal
1	CAM + 6.5V	6.3~6.7Vdc
2	CAM GND	-
3	CAM DIFF (H)	0~5V
4	CAM DIFF (L)	0~5V
5	CAM 1	NTSC signal
6	CAM 2	NTSC signal
7	CAM 3	NTSC signal
8	CAM shield	0~5Vdc

NTSC : National Television System Committee



3) GAUGE

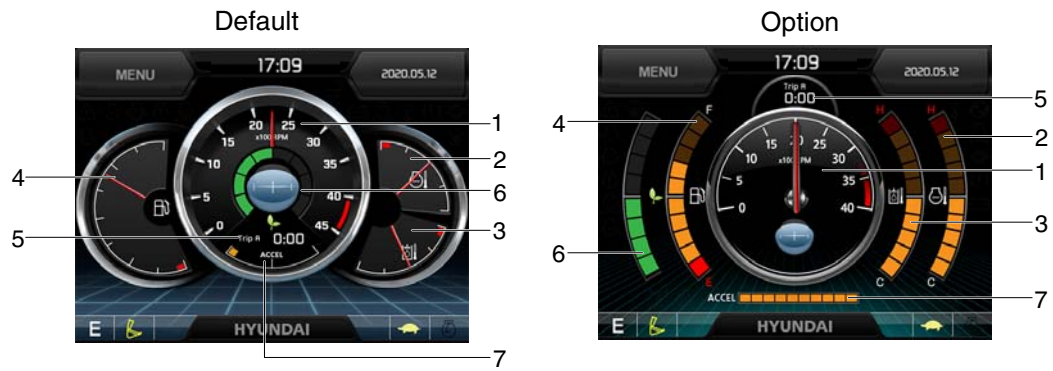
(1) Operation screen

When you first turn starting switch ON, the operation screen will appear.

Normal type



Premium type



- 1 RPM / Speed gauge
- 2 Engine coolant temperature gauge
- 3 Hydraulic oil temperature gauge
- 4 Fuel level gauge

- 5 Tripmeter display
- 6 Eco gauge
- 7 Accel dial gauge

※ Operation screen type can be set by the screen type menu of the display (premium type).
Refer to page 5-84 for details.

(2) RPM / Speed gauge

Normal type



Premium type



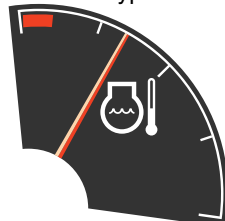
① This displays the engine speed.

(3) Engine coolant temperature gauge



Normal type



Premium type



220S3CD553

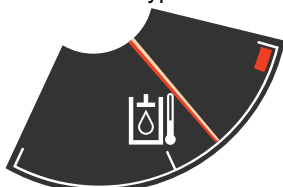
- ① This gauge indicates the temperature of coolant.
 - White range : 40-113°C (104-235°F)
 - Red range : Above 113°C (235°F)
 - ② If the indicator is in the red range or  lamp pops up and the buzzer sounds, turn OFF the engine and check the engine cooling system.
- ※ If the gauge indicates the red range or  lamp blinks in red even though the machine is in the normal condition range, check the electric device as this can be caused by poor connection of sensor.

(4) Hydraulic oil temperature gauge



Normal type



Premium type



220S3CD554

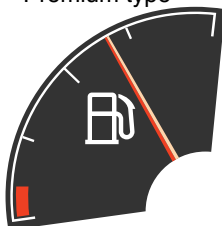
- ① This gauge indicates the temperature of hydraulic oil.
 - White range : 40-100°C (104-212°F)
 - Red range : Above 100°C (212°F)
 - ② If the indicator is in the red range or  lamp pops up and the buzzer sounds reduce the load on the system. If the gauge stays in the red range, stop the machine and check the cause of the problem.
- ※ If the gauge indicates the red range or  lamp blinks in red even though the machine is in the normal condition range, check the electric device as this can be caused by poor connection of electricity or sensor.

(5) Fuel level gauge



Normal type



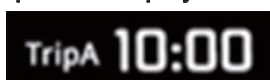
Premium type



220S3CD555

- ① This gauge indicates the amount of fuel in the fuel tank.
- ② Fill the fuel when in the red range, or  lamp pops up and the buzzer sounds.
- ※ If the gauge indicates the red range or  lamp blinks in red even though the machine is on the normal condition range, check the electric device as this can be caused by poor connection of electricity or sensor.

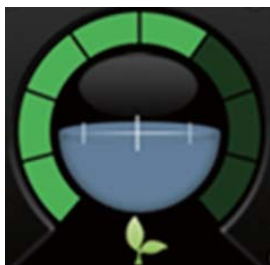
(6) Tripmeter display



290F3CD56

- ① This displays the engine the tripmeter.
- ※ Refer to page 5-85 for details.

(7) Eco gauge



290F3CD58

- ① This gauge indicates the fuel consumption rate and machine load status so that the operators can operate the machine efficient in regards to fuel consumption.
- ② Fuel consumption rate or machine load is higher if the number of segments are increased.
- ③ The color of Eco gauge indicates operation status.
 - White : Idle operation
 - Green : Economy operation
 - Yellow : Non-economy operation at a medium level.
 - Red : Non-economy operation at a high level.

(8) Accel dial gauge



290F3CD59

- ① This gauge indicates the level of accel dial.

4) WARNING LAMPS

Normal type






400SA3CD503

Premium type



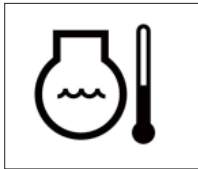
400SA3CD03

※ Warning lamps and buzzer

Warnings	When error happened	Lamps and buzzer
All warning lamps except below	Warning lamp pops up on the center of the LCD and the buzzer sounds	<ul style="list-style-type: none"> The pop-up warning lamp moves to the original position, blinks and the buzzer stops when; <ul style="list-style-type: none"> - the buzzer stop switch  is pushed - the lamp of the LCD is touched
 	Warning lamp pops up on the center of the LCD and the buzzer sounds	※ Refer to page 5-61 for details.

※ Refer to page 5-67 for the buzzer stop switch .

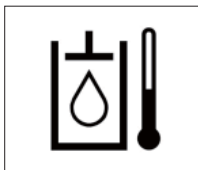
(1) Engine coolant temperature warning lamp



290F3CD61

- ① Engine coolant temperature warning is indicated in 2 steps.
 - 100°C over : The lamp pops up and the buzzer sounds.
 - 107°C over : The lamp pops up and the buzzer sounds.
- ② The pop-up , lamps move to the original position and blinks when the buzzer stop switch is pushed. The buzzer will stop and , lamps will blink.
- ③ Check the cooling system when the lamps keep blink.

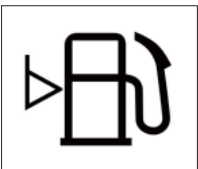
(2) Hydraulic oil temperature warning lamp



290F3CD62

- ① Hydraulic oil temperature warning is indicated in 2 steps.
 - 100°C over : The lamp pops up and the buzzer sounds.
 - 105°C over : The lamp pops up and the buzzer sounds.
- ② The pop-up , lamps move to the original position and blinks when the buzzer stop switch is pushed. The buzzer will stop and , lamps will blink.
- ③ Check the hydraulic oil level and hydraulic cooling system.

(3) Fuel level warning lamp



290F3CD63

- ① This warning lamp pops up and the buzzer sounds when the fuel level is below 136 ℓ (35.9 U.S. gal).
- ② Fill the fuel immediately after the lamp blinks.

(4) Emergency warning lamp



290F3CD64

- ① This warning lamp pops up and the buzzer sounds when each of the below warnings occurs.
 - Engine coolant overheating (over 107°C)
 - Hydraulic oil overheating (over 105°C)
 - MCU input voltage abnormal
 - Cluster communication data error
 - Engine ECM communication data error
- ※ The pop-up warning lamp moves to the original position and blinks when the buzzer stop switch is pushed. The buzzer will stop.
- ② When this warning lamp blinks, machine must be checked and serviced immediately.

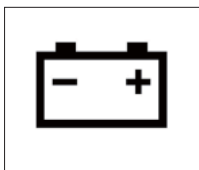
(5) Engine oil pressure warning lamp



290F3CD65

- ① This warning lamp pops up and the buzzer sounds when the engine oil pressure is low.
- ② If the lamp blinks, shut OFF the engine immediately. Check oil level.

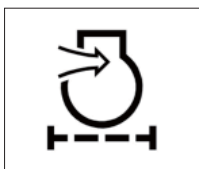
(6) Battery charging warning lamp



290F3CD67

- ① This warning lamp pops up and the buzzer sounds when the battery charging voltage is low.
- ② Check the battery charging circuit when this lamp blinks.

(7) Air cleaner warning lamp



290F3CD68

- ① This warning lamp pops up and the buzzer sounds when the air cleaner is clogged.
- ② Check, clean or replace filter.

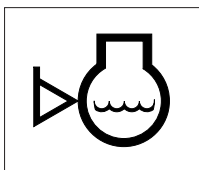
(8) Overload warning lamp (opt)



290F3CD69

- ① When the machine is overloaded, the overload warning lamp pops up and the buzzer sounds when the overload switch is ON. (if equipped)
- ② Reduce the machine load.

(9) Coolant level warning lamp



760F3CD58

- ① This warning lamp indicates lack of coolant.
- ② Check and refill coolant.

5) PILOT LAMPS













Normal type



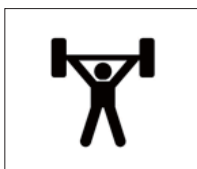
Premium type



(1) Mode pilot lamps

No	Mode	Pilot lamp	Selected mode
1	Power mode		Heavy duty power work mode
			Standard power mode
			Economy power mode
2	User mode		User preferable power mode
3	Work tool mode		General operation - IPC speed mode
			General operation - IPC balance mode
			General operation - IPC efficiency mode
			Breaker operation mode
			Crusher operation mode
4	Travel mode		Low speed traveling
			High speed traveling
5	Auto idle mode		Auto idle

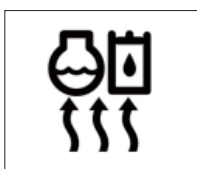
(2) Power max pilot lamp (null)



290F3CD78

- ① The lamp will be ON when pushing power max switch on the LH RCV lever.
 - ② The power max function operates for a max period of 8 seconds.
- ※ Refer to the operator's manual page 3-36 for power max function.

(3) Warming up pilot lamp



290F3CD80

- ① This lamp lights up when the coolant temperature is below 30°C (86°F).
- ② The automatic warming up is cancelled when the engine coolant temperature is above 30°C (86°F), or when 10 minutes have passed since starting the engine.

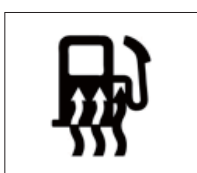
(4) Decel pilot lamp



290F3CD81

- ① Operating one touch decel switch on the RCV lever makes the lamp light up.
 - ② Also, the lamp will light up. And engine speed will be reduced automatically to save fuel when all levers and pedals are in the neutral position, and the auto idle function is selected.
- ※ **One touch decel is not available when the auto idle pilot lamp is turned ON.**
- ※ **Refer to the operator's manual page 3-35.**

(5) Fuel warmer pilot lamp



290F3CD82

- ① This lamp lights up when the coolant temperature is below 10°C (50°F) or the hydraulic oil temperature 20°C (68°F).
- ② The automatic fuel warming is cancelled when the engine coolant temperature is above 60°C (140°F), and the hydraulic oil temperature is above 45°C (113°F) since the start switch was ON position.

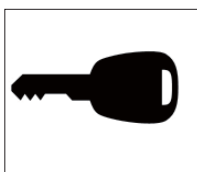
(6) Maintenance pilot lamp



290F3CD83

- ① This lamp lights up when consumable parts are in need of replacement. It means that the change or replacement interval of parts is 30 hours from the required change interval.
 - ② Check the message in maintenance information of main menu. Also, this lamp lights up for 3 minutes when the start switch is switched to the ON position.
- ※ **Refer to the page 5-78.**

(7) Smart key pilot lamp (premium type, opt)



290F3CD214

- ① This lamp lights up when the engine is started by the start button.
 - ② This lamp is red when the authentication fails, it will be green when it authentication is successful.
- ※ **Refer to the page 5-79.**

(8) Auto engine shutdown pilot lamp (premium type, opt)



220A3CD202A

- ① This lamp lights up when the auto engine shutdown is activated
- ※ **Refer to the page 5-75.**

(9) Cooling fan reverse pilot lamp



480A3CD205

① This lamp lights up when the cooling fan reverse function is activated.

※ Refer to page 3-21.

6) SWITCHES

Normal type



220S3CD586A

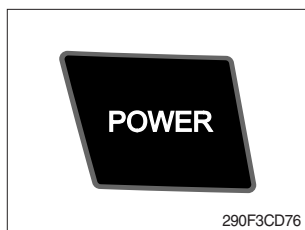
Premium type



220S3CD86B

※ When some of the switches are selected, the pilot lamps are displayed on the LCD. Refer to the page 5-63 for details.

(1) Power mode switch



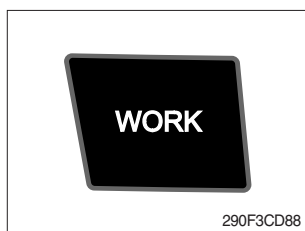
① This switch is to select the machine power mode and when pressed, the power mode pilot lamp will be displayed on the section of the monitor.

- P : Heavy duty power work.
- S : Standard power work.




② · E : Economy power work.

The pilot lamp changes E → S → P → E in this order.

(2) Work mode switch

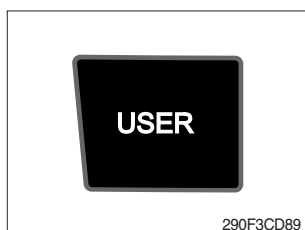


① This switch is to select the machine work mode, which shifts from general operation mode to optional attachment operation mode.

-  : General operation mode
-  : Breaker operation mode (if equipped)
-  : Crusher operation mode (if equipped)
- Not installed : Breaker or crusher is not installed.

※ Refer to the operator's manual page 2-7 for details.

(3) User mode switch

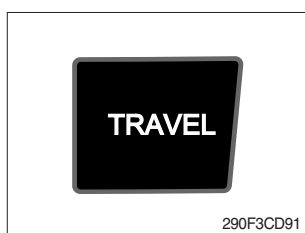


① This switch is used to select between user mode and general power mode.



- U : User mode
- P/S/E : General power mode

② Refer to the page 5-73 for another set of user mode.

(4) Travel speed switch



① This switch is used to select the travel speed alternatively.

-  : Low speed
-  : High speed

※ Do not change the setting of the travel speed switch while machine is moving. Machine stability may be adversely affected

⚠ Serious injury or death can result from sudden changes in machine stability.

(5) Auto idle/ buzzer stop switch



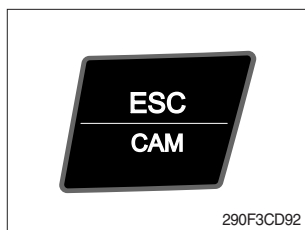
① This switch is used to activate or cancel the auto idle function.

- Pilot lamp ON : Auto idle function is activated.
- Pilot lamp OFF : Auto idle function is cancelled.

② The buzzer sounds when the machine has a problem.

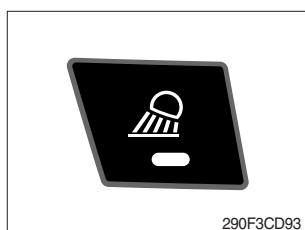
In this case, push this switch and buzzer stops, but the warning lamp blinks until the problem is cleared.

(6) Escape/Camera switch



- ① This switch is used to return to the previous menu or parent menu.
- ② In the operation screen, pushing this switch will display the view of the camera on the machine (if equipped). Please refer to page 5-85 for the camera.
- ③ If the camera is not installed, this switch is used only ESC function.

(7) Work light switch



- ① This switch is used to operate the work light.
- ② The pilot lamp lights up when this switch is pressed.

(8) Head light switch



- ① This switch is used to operate the head light.
- ② The pilot lamp lights up when this switch is pressed.

(9) Intermittent wiper switch



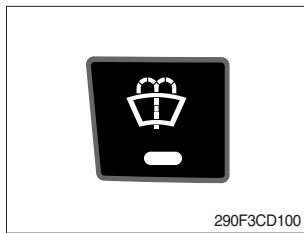
- ① This switch is used to wipe operates intermittently.
- ② The pilot lamp lights up when this switch is pressed.

(10) Wiper switch



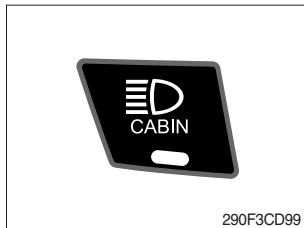
- ① This switch is used to operate the wiper.
- ② Note that the wiper will self-park when switched off.
- ③ The pilot lamp lights up when this switch is pressed.
- ※ If the wiper does not operate with the switch in ON position, turn the switch OFF immediately. Check the cause. If the switch remains ON, motor failure can result.

(11) Washer switch



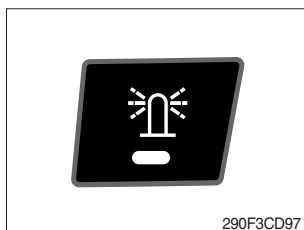
- ① Washer liquid is sprayed and the wiper is operated only when this switch is pressed.
- ② The pilot lamp lights up when this switch is pressed.

(12) Cab light switch



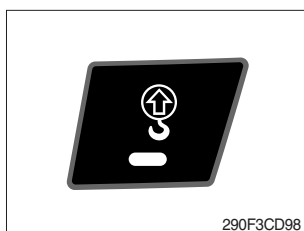
- ① This switch turns on the cab light.
- ② The pilot lamp lights up when this switch is pressed.

(13) Beacon switch



- ① This switch activates the rotary light on the cab.
- ② The pilot lamp lights up when this switch is pressed.

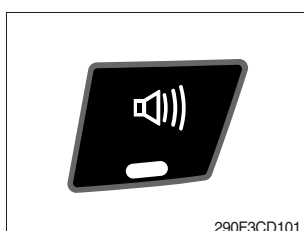
(14) Overload switch



- ① When this switch is activated, buzzer makes sound and overload warning lamp lights up in the event that the machine is or becomes in an overloaded situation.
- ② When the switch is inactivated, buzzer stops and warning lamp goes off.

⚠ Overloading the machine could impact the machines stability which could result in tipover hazard. A tipover hazard could result in serious injury or death. Always activate the overload warning device before you handle or lift objects.

(15) Travel alarm switch



- ① This switch is to activate travel alarm function surrounding when the machine travels to forward and backward.
- ② After activating this switch, the alarm operates only when the machine is traveling.
- ③ The pilot lamp lights up when this switch is pressed.

(16) Main menu quick touch switch



- ① This switch is to activate the main menu in the cluster.
※ Refer to the page 5-71.

7) MAIN MENU

- ※ On the operation screen, tap MENU to access the main menu screen.
On the sub menu screen, you can tap the menu bar to access functions or applications.

Normal type

Operation screen

MENU



Tap
MENU

Main menu screen



Sub menu screen



220S3CD502A

Premium type

Operation screen



Tap
MENU

Main menu screen










Sub menu screen



220S3CD102A

(1) Structure

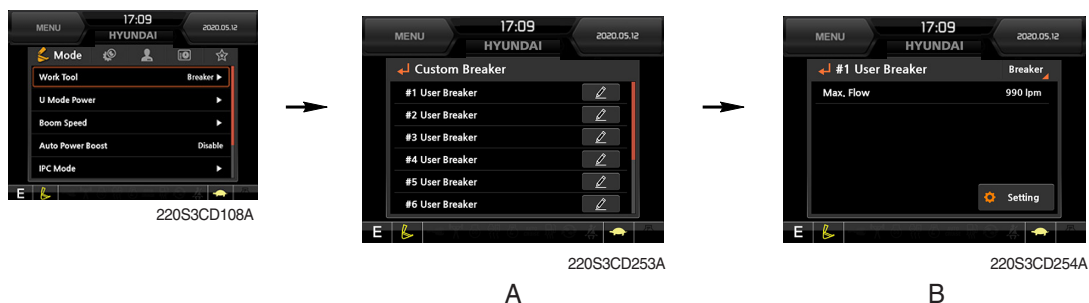
No	Main menu	Sub menu	Description
1	  Mode 220S3CD103	Work mode U mode power Boom speed (null) Auto power boost IPC mode Auto engine shutdown (opt) Initial mode Cooling fan reverse mode Emergency mode	Breaker, Crusher, Not installed User mode only Boom speed Enable, Disable Speed mode, Balance mode, Efficiency mode One time, Always, Disable Key on initial mode / initial work mode Auto, Manual Switch function
2	  Monitoring 220S3CD104	Active fault Logged fault Delete logged fault Monitoring	MCU, AAVM (opt) MCU, AAVM (opt) All logged fault delete, Initialization canceled Machine information, Switch status, Output status,
3	  Management 220S3CD105	Fuel rate information Maintenance information Machine security Machine information Contact Service menu Clinometer Update	General record, Hourly, Daily, Mode record Replacement, Change interval oils and filters ESL mode setting, Password change Model, MCU, Monitor RMCU, Relay drive unit, AAVM (opt) A/S phone number, A/S phone number change Power shift, Operating hour, Breaker mode pump acting, EPPR current level, Overload pressure Clinometer setting Cluster, ETC device
4	  Display 220S3CD106	Display item Clock Brightness Unit setup Language selection Screen type★	Engine speed, Tripmeter A, Tripmeter B, Tripmeter C Clock Manual, Auto Temperature, Pressure, Flow, Distance, Date format Korean, English, ETC A type, B type
5	  Utilities 220S3CD107	Tripmeter Camera setting AUX Manual	3 kinds (A, B, C) Number of active, Display order, AAVM (opt)★

★ : premium type

(2) Mode setup

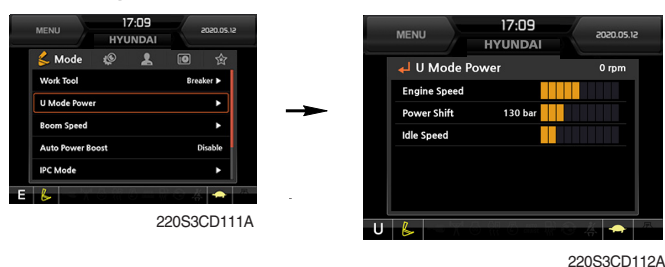
※ Illustrations are based on the premium type cluster.

① Work mode



- Select installed optional attachment
 - A : It can set the user's attachment.
It is available in setting #1~#10.
 - B : Max flow - Set the maximum flow for the attachment.

② U mode power

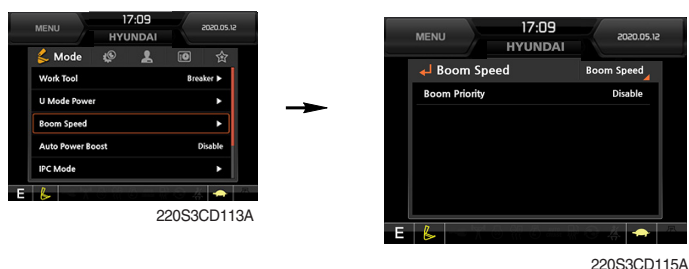


- Engine high idle rpm, auto idle rpm and pump torque (power shift) can be modulated and memorized separately in U-mode.
- U-mode can be activated by user mode switch.

Step (■)	Engine speed (rpm)	Idle speed (rpm)	Power shift (bar)
1	1400	800	0
2	1450	850	2
3	1500	900	4
4	1550	950	7
5	1600	1000 (auto decel)	10
6	1650	1050	13
7	1700	1100	16
8	1750	1150	19
9	1800	1200	22
10	1850	1250	25

※ One touch decel & low idle : 800 rpm

③ Boom speed (null)



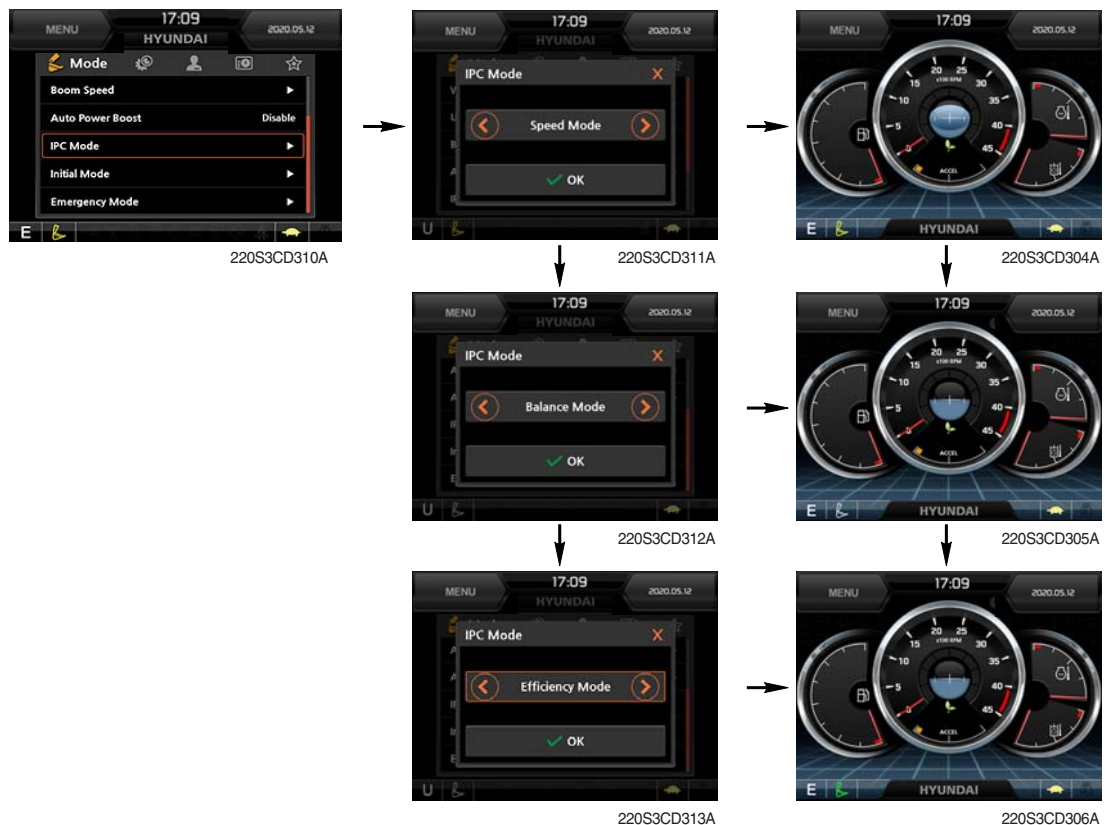
- Boom speed
 - Boom priority function can be activated or cancelled
Enable - Boom up speed is automatically adjusted as working conditions by the MCU.
Disable - Normal operation

④ Auto power boost



- The power boost function can be activated or cancelled.
 Enable - The digging power is automatically increased as working conditions by the MCU.
 It is operated max 8 seconds, then goes off for a period of 1 second and then activates again for 8 seconds and continues this cycle.
 Disable - Not operated.

⑤ IPC mode



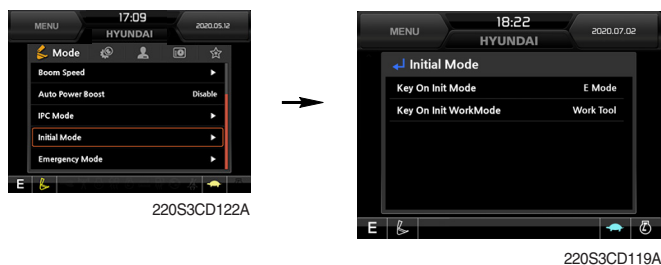
- The IPC mode can be selected by this menu.
 - Speed mode
 - Balance mode (default)
 - Efficiency mode

⑥ Automatic engine shutdown (option)



- The automatic engine shutdown function can be set by this menu.
 - One time
 - Always
 - Disable
 - Wait time setting : Max 40 minutes, min 2 minutes

⑦ Initial mode



- **Key on initial mode**
 - Selected the power mode is activated when the engine is started.

Key on initial work mode

- Not installed
- Last setting
- Work mode

⑧ Cooling fan reverse mode



- Automatic : Rotate the fan with reverse direction by preset cycle.
 - Interval : 30 minutes ~ 5 hours
 - Time : 30 seconds ~ 5 minutes
- Manual : Rotate the fan with reverse direction while pressing the Execute button.
- ※ **Default : interval (60 minutes), time (120 seconds)**

⑨ Emergency mode



220S3CD248A

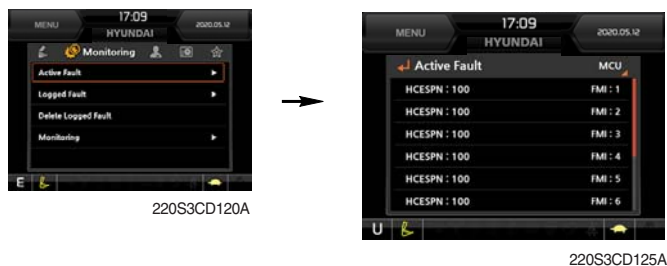


220S3CD249A

- This mode can be used when the switches are abnormal on the cluster.
- The cluster switches can be selected by touching each icon.

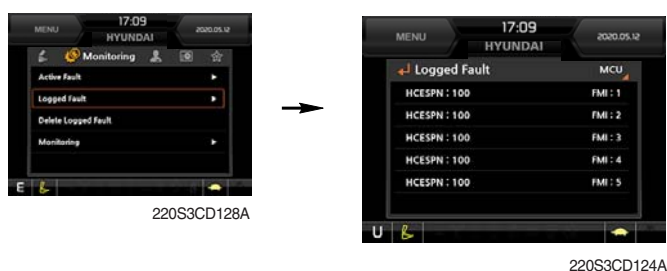
(3) Monitoring

① Active fault



- The active faults of the MCU can be checked by this menu.

② Logged fault



- The logged faults of the MCU can be checked by this menu.

③ Delete logged fault



- The logged faults of the MCU can be deleted by this menu.

④ Monitoring



- The machine status such as the engine rpm, oil temperature, voltage and pressure etc. can be checked by this menu (Analog input).
- The switch status or output status can be confirmed by this menu (Digital input & Digital output).
- The activated switch or output pilot lamps ● will light up.

(4) Management

① Fuel rate information



220S3CD14A



220S3CD15A

A



220S3CD16A

B



220S3CD17A

C



220S3CD18A

D



220S3CD19A

· General record (A)

- Average fuel rate (left) (from "Reset" to now)
Fuel consumption divided by engine run time (service meter time).
- A days fuel used (right)
Fuel consumption from 24:00 (or "Reset" time) to now (MCU real time).

· Hourly record (B)

- Hourly fuel rates for past 12 hours (service meter time).
- No record during key-off time.
- One step shift to the right for every one hour.
- Automatic deletion of data from 12 hours and earlier.
- "Reset" deletes all hourly records.

· Daily record (C)

- Daily fuel consumption for past seven days (MCU real time).
- No record during key-off time.
- One step shift to the right at 24:00 for every day.
- Automatically deletes data from 7 days and earlier.
- All daily records deletion by "Reset".

· Mode record (D)

- Average fuel rate for each power mode/accel dial (at least 7) from "Reset" till present.
- No record during idle.
- All records can be deleted by "Reset".

② Maintenance information



220S3CD131A



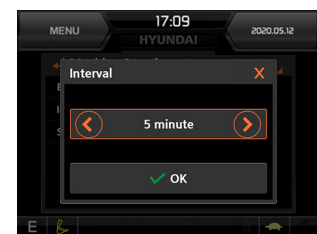
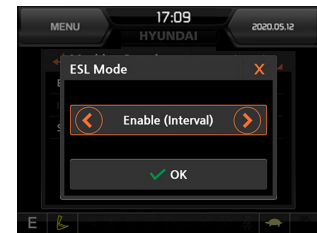
220S3CD132A



220S3CD133A

- Alarm lamp (●) is ON when oil or filter needs to be changed or replaced.
 - Replacement : The elapsed time will be reset to zero (0).
 - Change interval : The change intervals can be changed in hour increments of 50.
- ※ Refer to section, Maintenance chart for further information of maintenance interval.

③ Machine security



· ESL mode setting

- ESL : Engine Starting Limit
- ESL mode is designed to be a theft deterrent or will prevent the unauthorized operation of the machine.
- When you Enable the ESL mode, the password will be required when the starting switch is turned to the on position.

- Machine security

Disable : ESL function is disabled and password is not required to start engine.

Enable (always) : The password is required whenever the operator starts engine.

- Interval : The password is required when the operator starts engine first. But the operator can restart the engine within the interval time without inputting the password. The interval time can be set to a maximum 4 hours.

※ Default password : 00000 +

※ Password length : (5~10 digits) +

- Smart key (option) : Refer to next page.

· Password change

- The password is 5~10 digits.



Enter the current password



Enter the new password



Enter the new password again

※ Before first use, please set user password and owner password in advance for machine security.

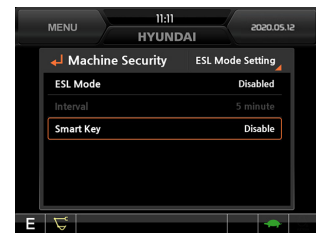
- Smart key



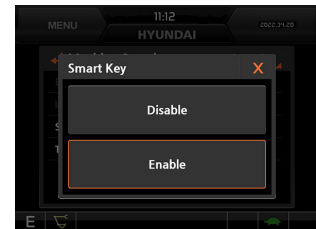
220S3CD190A



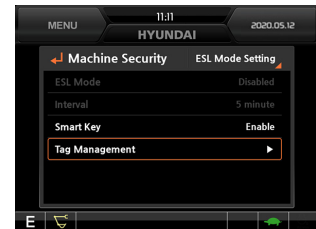
220S3CD135A



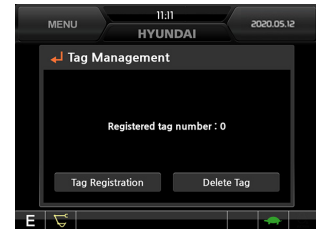
235F3CD001



235F3CD002

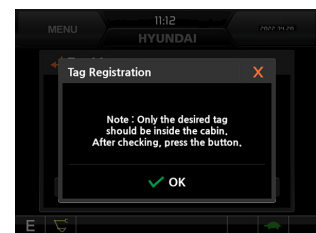


235F3CD003



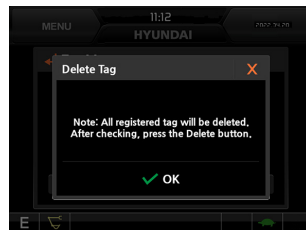
235F3CD004

Registering



235F3CD005

Deleting



235F3CD006

- Smart key is registered when equipped with optional smart key. If smart key is not inside of the cabin, authentication process fails and the password is needed.
- Tag management menu is activated when the Smart key menu is Enabled.
You can register and delete the tags.

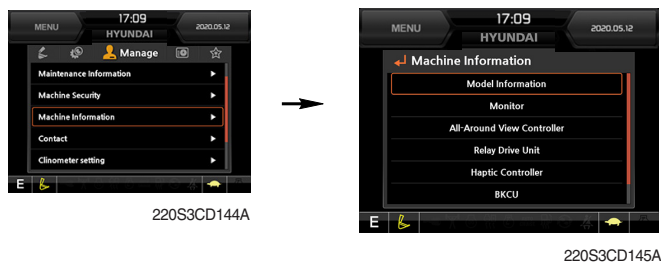
- Tag management

- When registering a tag : Only the tag you want to register must be in the cabin.
- When deleting a tag : All registered tags are deleted.

※ Engine Starting Condition

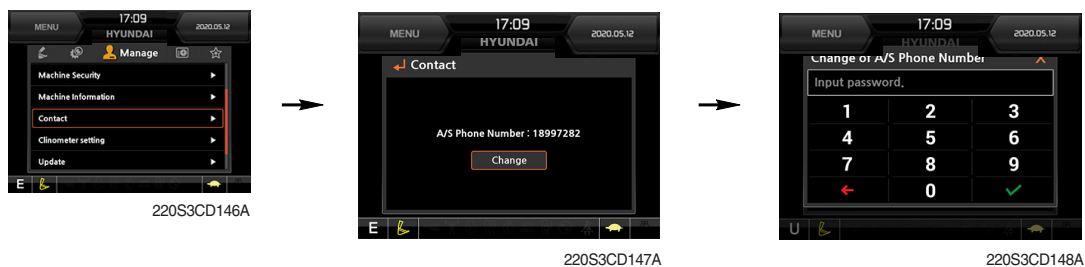
Case	ESL Mode	Smart Key	Condition
1	Disable	Disable	- With registered tag : Engine can be started without password input. - Without registered tag : Engine can be started without password input.
2	Disable	Enable	If Smart Key is enabled, ESL Mode is automatically enabled. This Case 2 work the same as the Case 4.
3	Enable	Disable	- With registered tag : Engine can be started with password input. - Without registered tag : Engine can be started with password input.
4	Enable	Enable	- With registered tag : Engine can be started without password input. - Without registered tag : Engine can be started with password input.

④ Machine Information



- This can confirm the identification of the model information (ECU), MCU, monitor, switch controller, RMCU, relay driver unit, AAVM (opt).

⑤ Contact (A/S phone number)



Enter the new A/S phone number

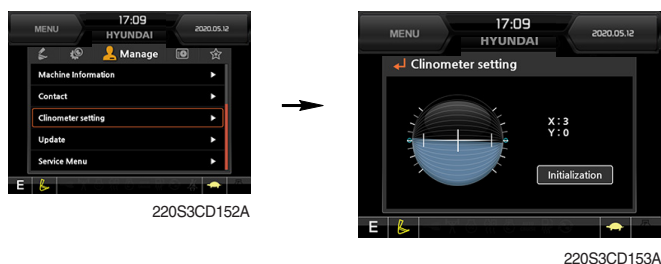
⑥ Service menu



※ This menu can be used only HCE service man and can not be accessible by the owner and the operator.

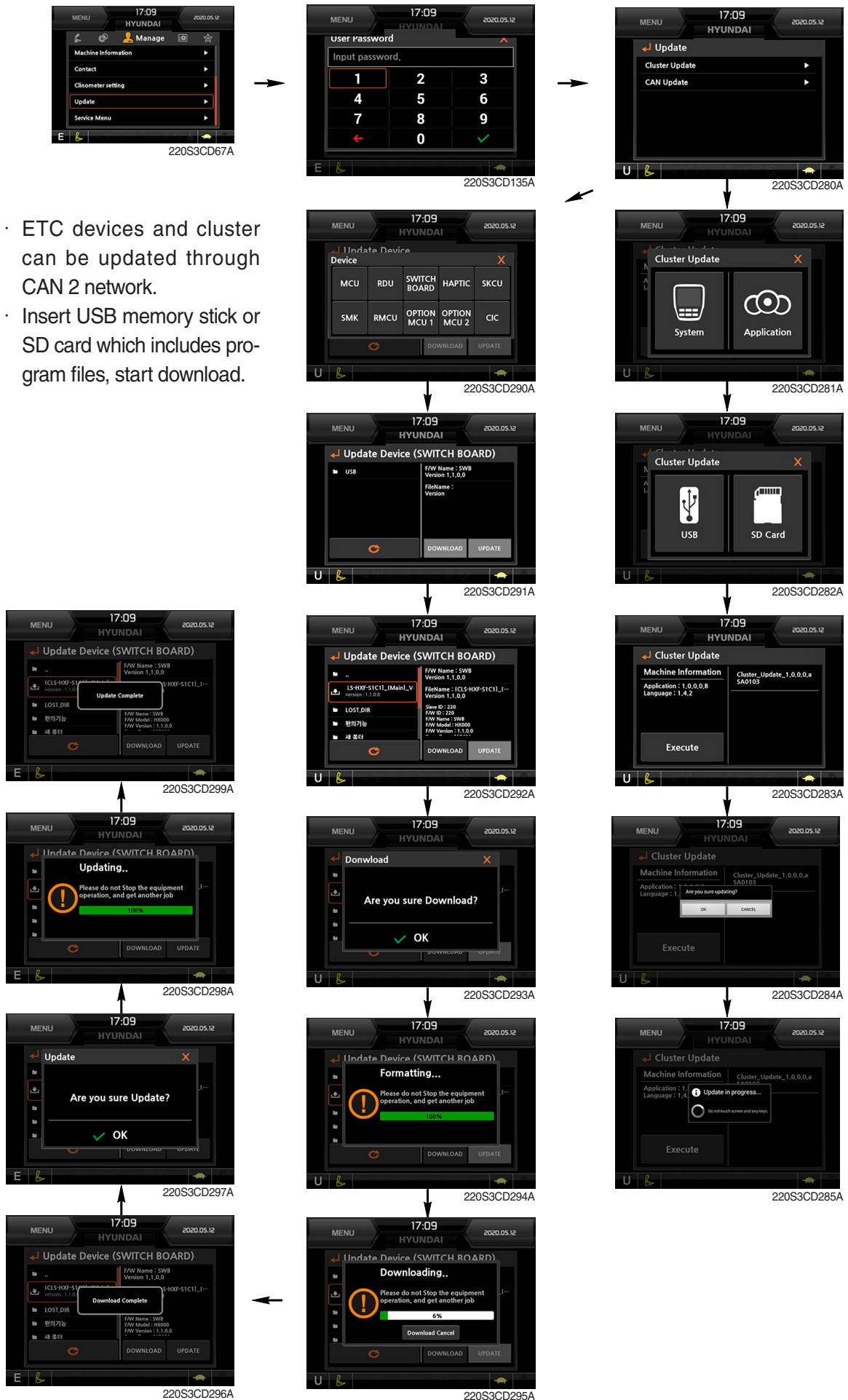
- Power shift (standard/option) : Power shift pressure can be set by option menu.
- Operating hours : Operating hours since the machine line out can be checked by this menu.
- Breaker mode pump acting (null)
- EPPR current level (attach flow EPPR 1 & 2)
- Overload pressure : 100 ~ 350 bar

⑦ Clinometer



- When the machine is on the flatland, if you touch "initialization" on cluster, the values of X, Y will reset to "0".
- You can confirm tilt of machine in cluster's operating screen.

⑧ Update (cluster & ETC devices)



(5) Display

① Display item



- The center display type of the LCD can be selected by this menu.
- The engine speed or the tripmeter menu (A,B,C) is displayed on the center display.

② Clock



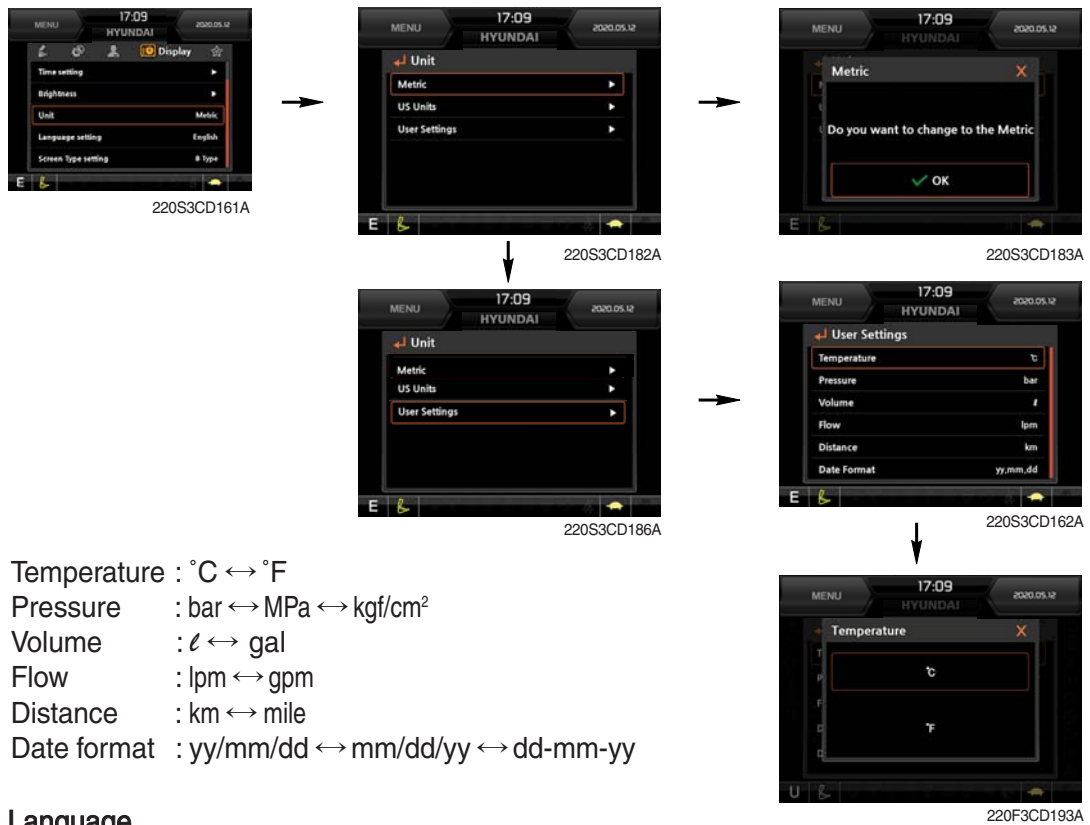
- The first row of boxes indicate Year/Month/Day.
- The second row shows the current time. (0:00~23:59)

③ Brightness



- If "Auto" is chosen, brightness for day and night can be set accordingly. Also by using the bar in lower side, users can define which an operation interval belongs to day and night. (in bar figure, white area represents night time while orange shows day time)

④ Unit



⑤ Language



- User can select preferable language and all displays are changed to the selected language.

⑥ Screen type (premium type)



220S3CD165A



A Type (Default) 220S3CD166A



220S3CD156A



B Type (Option) 220S3CD174A



220S3CD167A

(6) Utilities

① Tripmeter



220S3CD168A



220S3CD169A

- A maximum of 3 kinds of tripmeters can be used at the same time.
- Each tripmeter can be turned on by choosing "Start". it also can be turned off by choosing "Stop".
- If the tripmeter icon is activated in the operation screen, it can be controlled directly there.

② Camera setting

- If the rear camera is not installed on the machine, set disable.
- If the rear camera is installed on the machine, set enable.



220S3CD225A



220S3CD255A



220S3CD256A

- In the operation screen, rear camera screen shows up when ESC/CAM switch is pushed.



220S3CD222A



290F3CD221

③ AAVM (Advanced Around View Monitoring, premium type, opt)

- The AAVM switches of the cluster consist of ESC/CAM and AUTO IDLE/Buzzer stop.



220S3CD244A

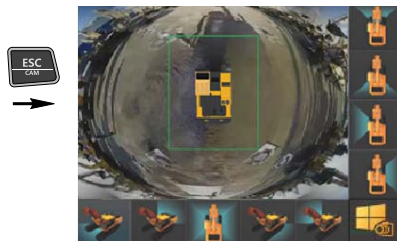
- Escape switch

- Activates AAVM mode from the beginning if AAVM is installed.
- While in the AAVM mode, select the ESC switch to return to the home screen.



220S3CD156A

Home screen



AAVM mode

235SA3CD222A

- Buzzer stop switch

- AAVM mode detects surrounding pedestrians or objects and the warning buzzer sounds.
- User can turn OFF the warning sound by pressing buzzer stop switch.



290F3CD246A

- When a worker/pedestrian reaches the green line, which is an external danger area equipped on the cluster, warning buzzer sounds and it displays a green rectangular box recognizing the worker/pedestrian.
Stop work immediately. Stop the buzzer by pressing the buzzer stop switch. Then resume work after you confirm that the area is safe and clear of workers/objects.



290F3CD247A

- When a worker/pedestrian reaches the red line, which is an external danger area equipped on the cluster, warning buzzer sounds and it displays a red rectangular box recognizing the worker/pedestrian.
Stop work immediately. Stop the buzzer by pressing the buzzer stop switch. Then resume work after you confirm that the area is safe and clear of workers/objects.

▲ Failure to comply may result in serious injury or death.

※ In AAVM mode, a touch screen of the LCD is available only.

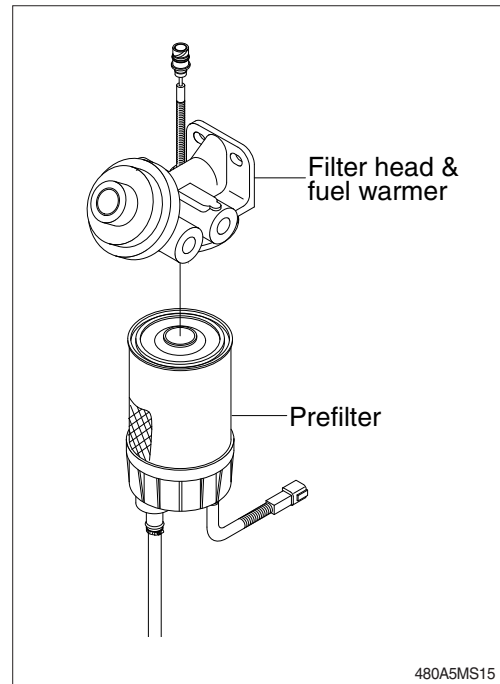
GROUP 16 FUEL WARMER SYSTEM

1. SPECIFICATION

- 1) Operating voltage : 24 ± 4 V
- 2) Power : 350 ± 50 W
- 3) Current : 15 A

2. OPERATION

- 1) The current of fuel warmer system is automatically controlled without thermostat according to fuel temperature.
 - 2) At the first state, the 15 A current flows to the fuel warmer and engine may be started in 1~2 minutes.
 - 3) If the fuel starts to flow, ceramic-disk in the fuel warmer heater senses the fuel temperature to reduce the current as low as 1.5 A.
- So, fuel is protected from overheating by this mechanism.



3. ELECTRIC CIRCUIT

