



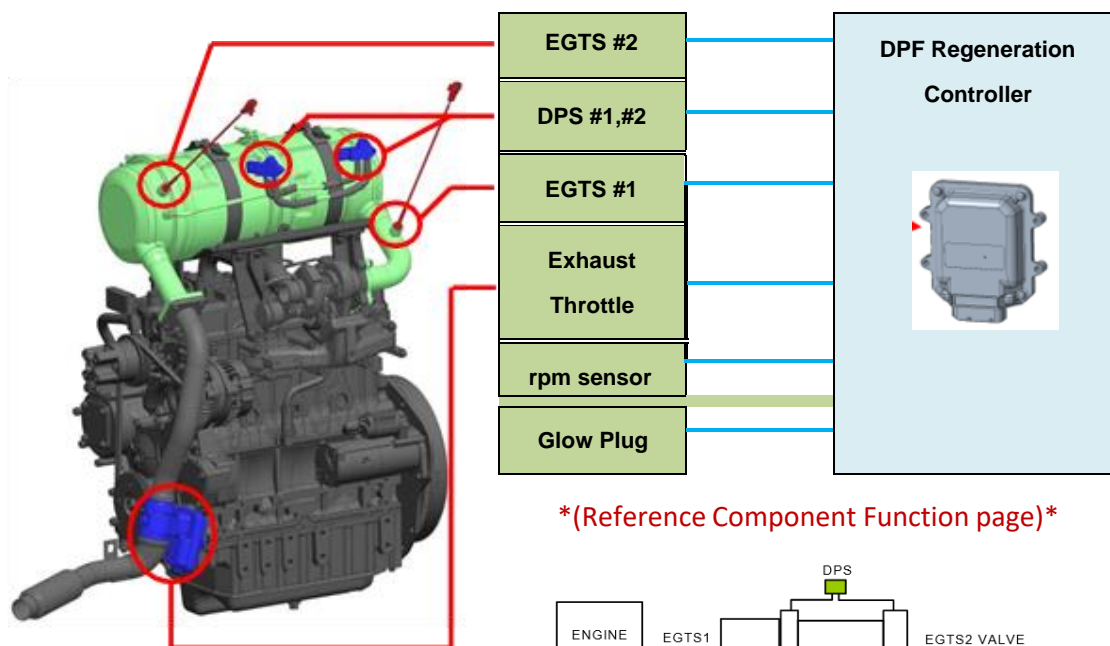
## Description:

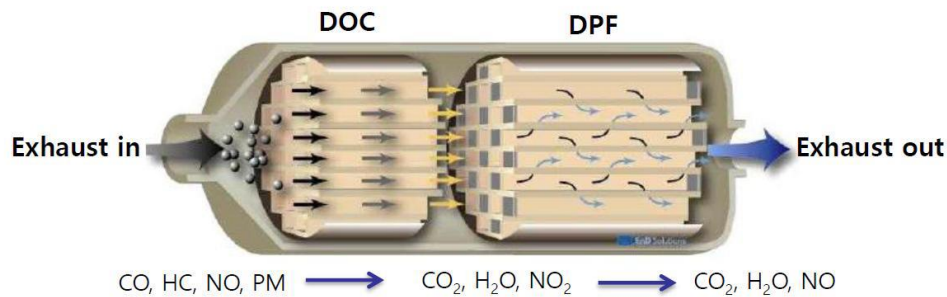
### 1. Branson DPF system & Regeneration

#### WHAT DOES DPF STAND FOR & WHAT DOES IT DO?

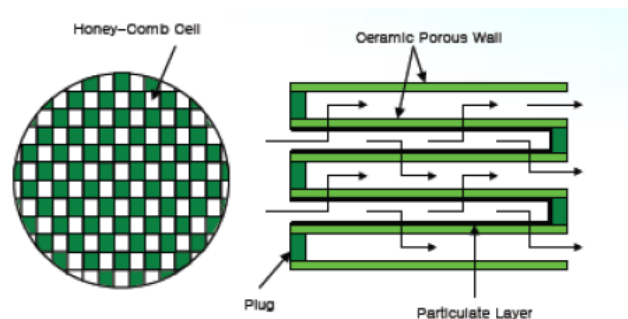
The DPF System has 2 main parts The Diesel Particulate Filter (DPF) & The Diesel Oxidation Catalyst (DOC) and both make up the system Branson uses in emissions-control, to catch the remaining particulate matter left over from the combustion cycle that accumulate into visible smoke from the exhaust. The DPF captures many of these particulates, helping eliminate the 'smoke' from proceeding into the air.

The DPF is an exhaust component that continually clogs from operation, this filter is built into a system where it essentially clean itself of the buildup. In doing so the filter can more efficiently capture particles within exhaust gases and more easily pass through the airflow from intake to output. A regeneration cycle occurs by essentially 'cooking' the filter clean again. The DPF Regen contains the heat of the exhaust, adding up to temperatures exceeding 1000 degrees Fahrenheit, so that the filter is depleted of its buildup and returns to proper functioning capabilities.





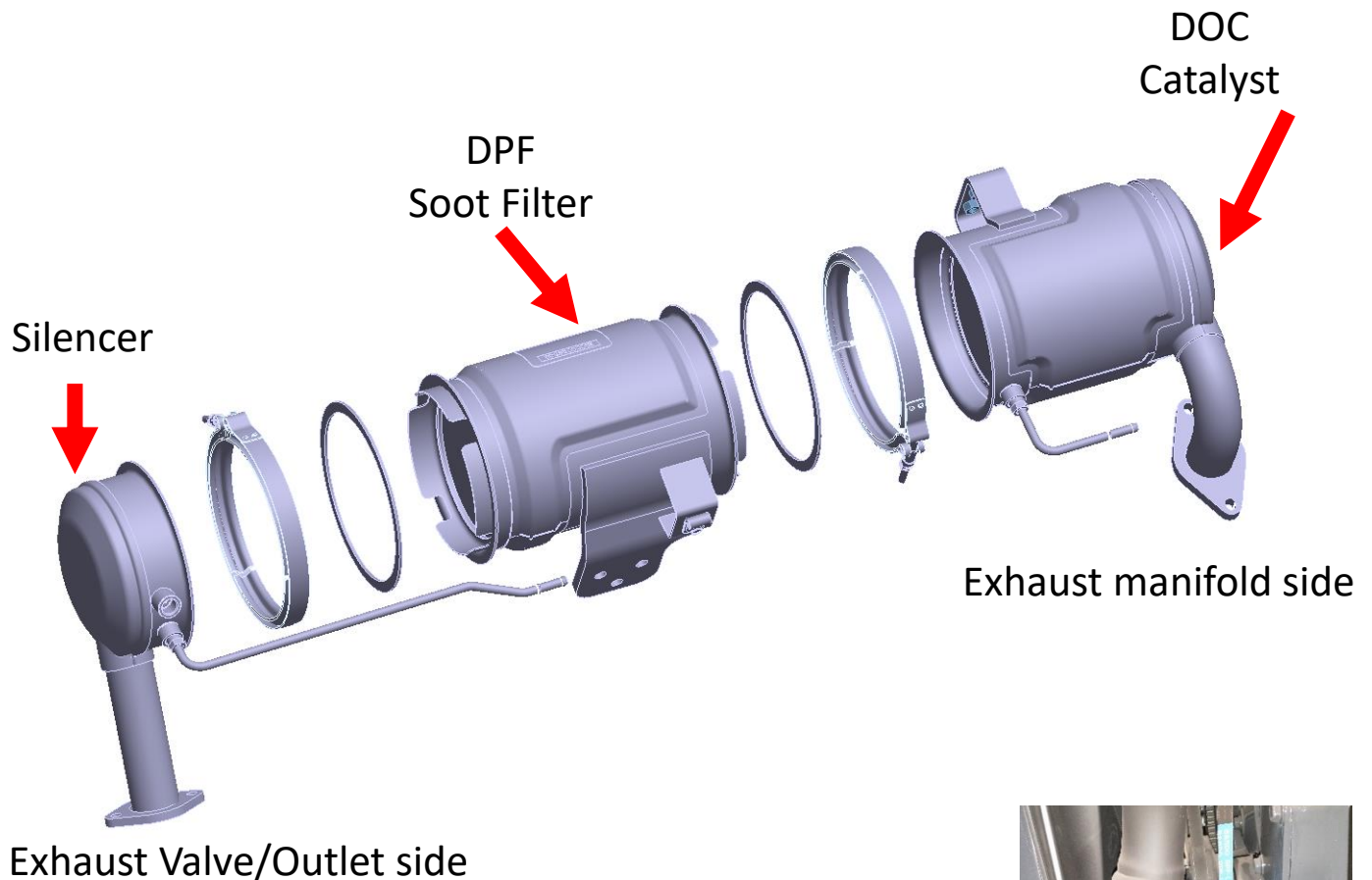
**Diesel Particulate Filters (DPF)** utilize cordierite wall-flow monoliths to trap the soot produced by diesel engines. The cylindrical filter element consists of many square parallel channels running in the axial direction, separated by thin porous walls. The channels are open at one end and plugged at the other, which forces the particle laden exhaust gases to flow through the walls. Gas is able to escape through the pores in the wall material. Particulates, however, are too large to escape and are trapped in the filter walls and in the inlet channels. A proprietary noble metal catalyst is coated onto the inside surface of the filter monolith. The catalyst lowers the soot combustion temperature allowing the filter to regenerate. The accumulated soot is oxidized in the filter during regular operation of the engine.



**The Diesel Oxidation Catalyst (DOC)** are catalytic converters designed specifically for diesel engines and equipment to reduce Carbon Monoxide (CO), Hydrocarbons (HC) and Particulate Matter (PM) emissions. DOC catalytic converters consist of a monolith honeycomb substrate coated with platinum group metal catalyst, packaged in a stainless steel container. The honeycomb structure with many small parallel channels presents a high catalytic contact area to exhaust gasses. As the hot gases contact the catalyst, several exhaust pollutants are converted into harmless substances: carbon dioxide and water.



## Branson DPF Components



## Electronic Exhaust Valve

**The Valve is closed after Regen is Started**

- The back pressure of the engine is increased
- the load of the engine is generated
- the exhaust gas temperature is raised
- The DPF is regenerating

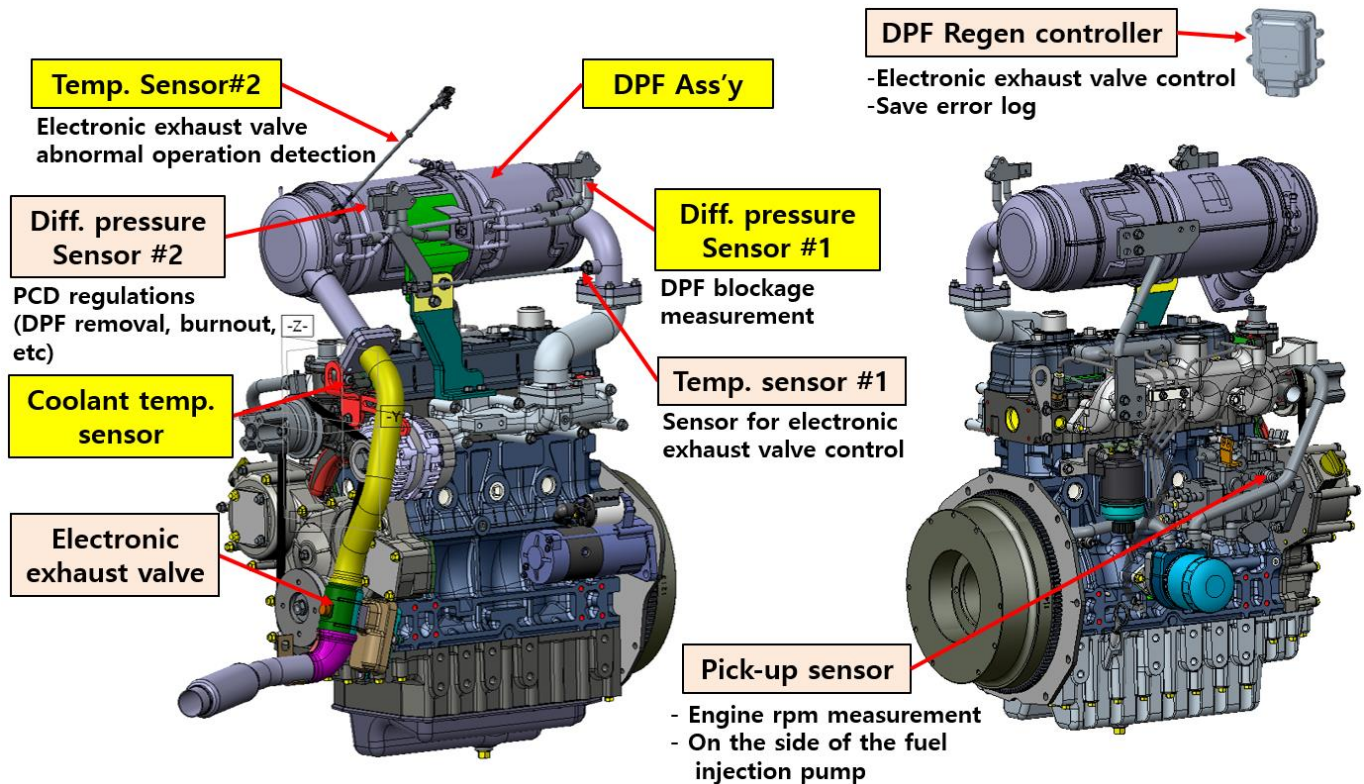
20 Series



15 & 35 Series



# Component Function



Part	Q'ty	Note
EGTS - Exhaust Temp Sensor	2	To detect the temperature of the front and rear of the DPF using EGTS (Exhaust Gas Temperature Sensor)
DPS – Differential Pressure Sensor	2	To determine the timing of regeneration by sensing DPS (Differential Pressure Sensor)
RPM Sensor	1	To use for DPF regeneration condition and display on the instrument panel by sensing RPM pulse with pick up sensor
DPF Regen Controller	1	To control the following functions by monitoring each sensors. <ul style="list-style-type: none"> <li>Diagnostic Error of sensors</li> <li>Control the warm-up controller</li> <li>Display lamp and data on the instrument panel</li> <li>Buzzer control</li> <li>DPF regeneration control</li> </ul>
Instrument Panel	1	To display RPM, engine coolant temperature, and various lamps by using the data which is sent via CAN communication from DPF Regeneration controller



# The DPF Regeneration:

## 1) Self Regeneration (Passive)

Self or Passive regeneration process is controlled by the engine's exhaust temperature, that occurs naturally from the engine's combustion. This takes place during normal operation and requires no operator input. If the engine is run under a heavy load and at high RPM the higher exhaust temperatures will generate enough exhaust heat to burn off the particulate matter. No action is required and no icons are displayed on the Instrument Cluster. The operation of the machine is normal during self regeneration. During Self regeneration the Particulate matter (PM) build-up is monitored by differential pressure and exhaust temperature being measured across the DPF.

## 2) Stationary Regeneration

Stationary/ Parked regeneration is used when the Self (Passive) regeneration did not adequately reduce the PM in the DPF. This process requires the operator or technician to start a Parked regeneration with the Regen Button (ACK) it typically takes about 30 minutes. The regeneration cycle must be performed while the machine is parked. The Stationary DPF regeneration method is done through the increase of the exhaust gas temperature by increasing the back pressure of the engine using the electronic exhaust valve in the exhaust pipe after the DPF. When the Stationary/Parked regeneration is required, an audible alarm will go off 3 times and DPF light on the instrument cluster will flash.

## 3) Failed Regen Repair

When the Stationary Regen Fails and the DPF is too clogged then the DPF Filter is Replaced or Repaired. To repair the DPF it will need to be taken to a 3<sup>rd</sup> party to be baked/cleaned and the PM inside the filter will be disposed of properly.

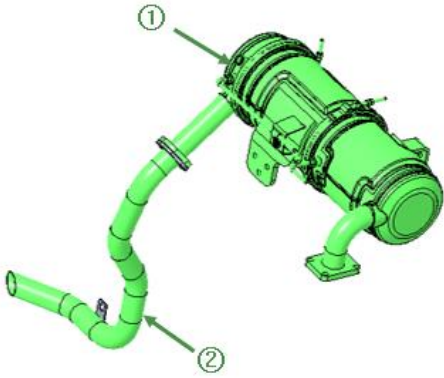
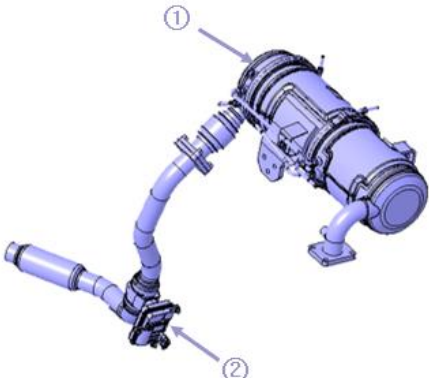
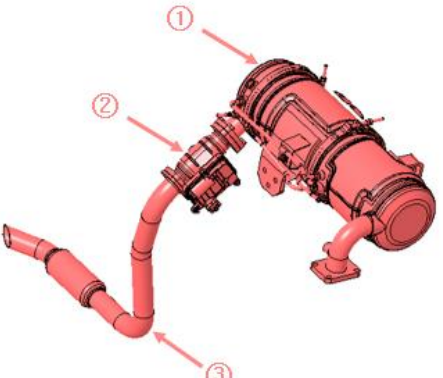
## \* Important Maintenance Reminders

Using the right types of diesel fuel and engine oil is also critical to keep your Tier 4 engine performing reliably. Ultra-low sulfur diesel fuel (less than 15 parts-per-million sulfur content) is absolutely required for use in all Tier 4 engines for both regulatory and technical reasons. Diesel fuel with higher than 15 ppm sulfur content can degrade the diesel oxidation catalyst (DOC), which can potentially cause operational problems and may jeopardize long-term component life.

In addition, Tier 4 diesel engines require CJ-4 specification (or higher) low-ash oil. CJ-4 engine oil is engineered to sustain emission control system durability with diesel particulate filters used on Tier 4 engines. Using engine oils other than CJ-4 can cause premature clogging of the DPF and a subsequent reduction in engine performance.



# Different Production Types of Branson's DPF System

2014-2019 Tractors	2020 to Present Series	2020 to Present Series / 35 Series
		
<p>① DPF: EA00003230E EA00003227C (A2300T)</p> <p>② Tail Pipe: TA00049271B(20) Tail Pipe: TA00040589C(15)</p> <p>❖ Data logger: EA00003292B</p>	<p>① DPF: EA00005808B</p> <p>② Exhaust valve: EA00005796A (Combined with tail pipe)</p> <p>❖ DPF Re-Gen Controller: EA00006285B</p>	<p>① DPF: EA00006091A</p> <p>② Exhaust valve: EA00005795A (Separate of tail pipe)</p> <p>③ Tail pipe: TA00060420A(15) Tail pipe: TA00061691A(35)</p> <p>❖ DPF Re-Gen Controller: EA00006285B</p>

# How to Perform a Stationary Regen:

When the DPF Regen alarm buzzer is audible, the driver should perform the following method.

**Step 1)** The operator must Park the tractor with the parking brake on. Then make sure Range Gear is in Neutral, Shuttle lever is in Neutral (Or HST Pedals Neutral) and make sure cooling temp is between 60°C~100°C, Then finally manually accelerate RPM Lever to 2850 RPM.

**Step 2)** Press the Regen Button and hold for 30 seconds. (may take longer) Until the DPF lights turn on solid on the instrument cluster and the Regen button is blinking, buzzer alarms for 2 seconds at start then once the regen begins buzzer sounds once every 3 minutes.



On



Blinking

**Step 3)** The Regeneration is completed within 30-35 minutes the DPF light on Cluster go out and the buzzer sounds 3 times after 3 minutes of DPF Regeneration completion.



DPF lights amber &  
Engine light Red

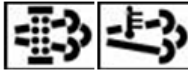
Regen Button




# How To Reset: The DPF REGEN & Check Engine lamp.


The procedure for resetting the DPF REGEN controller is as follows. After Learning Mode is started, 'learning' must be executed.

- 1) **Learning Mode**: If the DPF button () is pressed for 15 seconds immediately

after "IG KEY-ON", the symbol  will flash at 0.5 seconds + 2 second intervals on the instrument panel. Then turn off the key.

- 2) **Learning**: After executing 'IG KEY-ON' again, immediately press and release the DPF

playback button () three times. (You'll hear the valve shut and open.) When

'learning' is completed, the symbol  flashes three times on the instrument panel. Then turn off the key.















- 3) **Check**: Mechanical sound is heard from the exhaust valve in the 'IG KEY-ON' state.

## \* Important Note\*

This is only when DPF and or Check engine light is on solid or flashing **without** the audible buzzer alarm



## Error display during DPF regeneration

Items	Lamp indication	Description
Engine overheating	  Repeats 0.5Sec Blinking	Active when the cooling water temperature exceeds 110 degrees during DPF regeneration. You can not retry regeneration within 10 minutes. <b>[Buzzer] Repeat 1Sec Sound On-&gt; 0.5 Sec Sound Off, and if it goes below 100 degrees, Buzzer is turned off.</b>
Regeneration fail	  Repeats 0.5Sec Blinking	By judging after the end of the regeneration period, it activates when the differential pressure doesn't decrease by more than 100mbar compared with the start of regeneration even though the differential pressure is blocked at the start of regeneration
3 times consecutive regeneration failure	   Repeats 0.5Sec Blinking	Even if the DPF regeneration has been completed, if 3 consecutive regenerations the pressure difference due to soot was not reduced. → Please contact the service center
Regeneration off	  Repeats 0.5Sec Blinking	If regeneration stop during regeneration operation for any of the following reasons <ul style="list-style-type: none"> <li>- Engine less than 2600rpm</li> <li>- Pre DPF(EGTS1) temp. overheat over 650 degrees</li> <li>- Post DPF(EGTS2) temp. overheat over 550 degrees</li> <li>- Not parking</li> <li>- Not Neutral</li> </ul>
Engine stop during regeneration	   0.5Sec blinking(For 10 minutes)	Blinking for 10 minutes if engine stop is detected during regeneration and the differential pressure is greater than 130 mbar at restart.
DPF error	  light on	Active when the DPF is damaged or removed

### ※ Details of Regeneration failure

When regeneration failure lamp is displayed (   blinking repeatedly) after regeneration start.

### Case 1) Regeneration in progress







- 1) When the cooling water temperature is over 110°C ← Engine overheating
- 2) If the #2 temperature sensor is 550°C or higher, ← DPF damaged
- 3) Various sensor error detection or less than 2600rpm ← sensor error or engine high rpm not reached
- 4) Electronic Exhaust Valve stuck ← When the target position cannot be followed by valve stuck

### Case 2) After completion of Regeneration









- 1) Cooling water temperature below 60 degrees ← Coolant temperature sensor error or wiring error
- 2) If the differential pressure was over 130mbar at the start of regeneration, but did not decrease by more than 100mbar at the start, ← DPF regeneration fail(Exhaust valve defect, exhaust gas leakage, etc.)



## Instrument Panel Lamp Description

### Sensor error indication & Corrective action

Items	Lamp indication	Description & Action
RPM error (CPS)	 light on	Occurs when the engine starts but the RPM signal (Pick Up sensor) is not detected. Engine start judgment: Generator voltage rise → RPM sensor assembled in fuel injection pump, wiring check required
Water temperature sensor error (WTS)	 light on	Activates when the water temperature sensor is out of range(0.16V~4.78V) ✓ For this error, the water temperature is displayed at 138 degrees. ✓ If open circuit, the measured voltage is 5V → Coolant temperature sensor assembled on coolant pump, wiring check required
Differential pressure sensor error (DPS1=1000mbar) (DPS2=180mbar)	 Repeats blinking twice every 2.5 seconds	Active when the differential pressure sensor is out of range <u>DPS1 : 0.3V~4.78</u> ✓ Below 0.5V is 0mbar ✓ Over 4.5V is 1000mbar <u>DPS2 : 0.3V~4.9V</u> ✓ Below 0.72V is 0mbar ✓ Over 4.72V is 180mbar ✓ If open circuit, the measured voltage is 5V → Check differential pressure sensor disconnection and check whether the pressure hose is damaged.
Exhaust temperature sensor error (T1=Before DOC) (T2=After DPF)	 Repeats 0.5Sec Blinking	Active when the temperature sensor is out of range(T1,T2 : 0.3V~4.78V) ✓ If open circuit, the measured voltage is 5V → Temperature sensor assembled in DPF combination, wiring needs to be checked
Learning error of electric exhaust valve	  0.5Sec Blinking + 2Sec Blinking Repeat the above pattern	Active when the position of the electronic exhaust valve is not learned. The lamp continues to blink until the learning of the electronic exhaust valve is successful. → Learn method: Press the DPF Regen button 3 times within 5 seconds after Key-ON. ※ Learning is required when replacing the DPF controller or exhaust valve (new or used).

## Sensor error indication & Corrective action cont.

Electric exhaust valve error (VALVE)	  Repeats 0.5Sec Blinking	<p>Active when the position sensor of the electronic exhaust valve is out of the range (0.3V ~ 4.78V)</p> <p>✓ If open circuit, the measured voltage is 0V  → Need to check the actuator wiring connector and wiring of the electronic exhaust valve</p>
DPF error 1 (RMV1) (T1=Before DOC) (T2=After DPF)	  light on	<p>Active when the DPF is damaged or removed. RMV means removal and detects whether the DPF front/rear differential pressure sensor and front/rear temperature sensor are normal.</p> <p>1. DPS1, DPS2, T1, and T2 Sensors have simultaneously detected as an error.</p> <p>2. Occurs when DPS1 is measured at 0mbar for 10 seconds or more at engine 1200rpm or higher and T1/T2 both below 100°C.</p> <p>→ If the DPF is damaged, it needs to be replaced. DPF related sensors need to be checked. If an error is detected the warning light remains on the instrument panel, and the error needs to be cleared after inspection.</p>
DPF error 2 (RMV2)	  light on	<p>Active when the DPF is damaged or removed.</p> <p>1. 900rpm &lt; Engine rpm &lt; 1000rpm and cooling water temp is over 70°C and 0mbar &lt; DPS2 &lt; 2 mbar over 3 seconds.</p> <p>→ If the DPF is damaged, it needs to be replaced. DPF related sensors need to be checked. If an error is detected the warning light remains on the instrument panel, and the error needs to be cleared after inspection.</p>
Glow relay error	 Repeats 0.5Sec Blinking	<p>Glow Relay (Pin 25) Disconnection or Relay fault Lights up for more than 2 seconds.</p> <p>→ Need to check wiring or relay connected to glow plug</p>
Cooling water overheat	 on	<p>When the cooling water temp. is 110 degrees or higher</p> <p>→ Coolant pump check. Fan belt check (tension, breakage, etc.). Check for blockage of radiator and hood air hole</p> <p>option) HA00001566A instrument panel only</p>

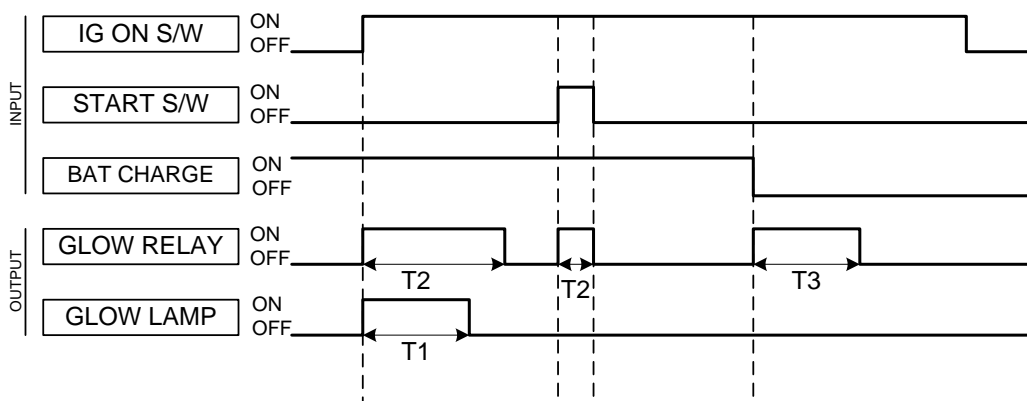
•Engine warning lamp  = 

•Cleaning logic (30% close operation of valve, prevention of valve seizure) is present at every key-on after learning the electronic exhaust valve

## Glow Control

To improve the initial start-up, the Glow Relay and Glow Lamp are controlled by setting the preheating time according to the engine coolant temperature.

### Timing Chart



### Operating time

	Water temperature sensor temperature (resistance / voltage)	Working time	Description
<b>T1 : LAMP TIME (sec)</b>	40°C or higher (0.8KΩ or less / 0.9V or less)	4.0 s	*) When the START switch is turned on, the remaining time is ignored.
	-15°C ~ 40°C (9.5KΩ~0.8KΩ / 0.9V ~ 3.62V)	10.0 s	
	-15°C or less (9.5KΩ or more / 3.62V or more)	14.0 s	
<b>T2 : PRE-GLOW TIME (sec)</b>	40°C or higher (0.8KΩ or less / 0.9V or less)	5.0 s	*)The remaining time is ignored when the alternator is running.
	20°C ~ 40°C (0.8KΩ~1.8KΩ / 0.9V ~ 1.67V)	10.0 s	
	20°C or less (1.8KΩ or more / 1.67V or more)	30.0 s	
<b>T3 : AFTER-GLOW TIME (sec)</b>	60°C or higher (0.4KΩ or less / 0.5V or less)	5.0 s	
	60°C or less (0.4KΩ or more / 0.5V or more)	120.0 s	

\*) When Start S / W (Cranking) is On, Glow Relay is connected even if Pre Glow (T2) Time has passed.

## Sensor Specifications

The voltage measured by the sensor indicates the voltage measured with the DPF Controller connected to the sensor

- Diff. Pressure Sensor 1 = Soot collection measurement sensor = DPS1  
mbar=millibar

<b>Measured Voltage</b>	<b>0.5V</b>	<b>4.5V</b>
<b>Differential Pressure</b>	0mbar	1000mbar

- Diff. Pressure Sensor #2 = DPF state measurement pressure sensor = DPS2  
High-precision sensor for DPF condition measurement

<b>Measured Voltage</b>	<b>0.72V</b>	<b>4.72V</b>
<b>Differential Pressure</b>	0mbar	180mbar

Engine speed [rpm]	Setting DPS [mbar]	Engine speed [rpm]	Setting DPS [mbar]
900	130	2100	210
1000	130	2200	220
1100	130	2300	230
1200	130	2400	240
1300	130	2500	260
1400	130	2600	260
1500	140	2700	280
1600	150	2800	290
1700	170	2900	300
1800	180	3000	300
1900	180	3100	300
2000	200		

- Exhaust Temperature Sensor  
- 1K pull-up resistance within DPF Controller

<b>Measured Voltage [V]</b>	<b>1.59</b>	<b>1.72</b>	<b>1.84</b>	<b>2.12</b>	<b>2.38</b>	<b>2.62</b>	<b>2.85</b>	<b>3.25</b>
<b>Temperature [°C]</b>	-40	-20	0	50	100	150	200	300

<b>Measured Voltage [V]</b>	<b>3.43</b>	<b>3.60</b>	<b>3.76</b>	<b>3.92</b>	<b>4.20</b>	<b>4.45</b>	<b>4.67</b>	<b>4.77</b>
<b>Temperature [°C]</b>	350	400	450	500	600	700	800	850

- Water Temperature Sensor

<b>Measured Voltage [V]</b>	<b>0.3</b>	<b>0.49</b>	<b>0.56</b>	<b>0.7</b>	<b>0.8</b>	<b>1.3</b>	<b>2.56</b>	<b>3.34</b>
<b>Temperature [°C]</b>	140	120	115	105	100	80	50	35