Solution K25470463
Monday, March 2, 2020 7:38:41 PM CET

** SOLUTION **

Title	Mack Chassis - Emcon (Spark Assist) Engine Aftertreatment System Troubleshooting Check Sheet - US07 Emissions

Mack Models

Mack Model	LEU , MRU - TerraPro

Emission Standard

Emission Standard	US07

Engine family

Engine family	MP7

** SOLUTION **

Cause	Mack Trucks continues to receive complaints regarding US07 MP7 spark assist troubleshooting.
Solution	It has been found that on these older chassis it is best to eliminate all the basics prior to opening an eService case. Pressure test the complete intake and exhaust systems. There is zero tolerance for leaks in these systems. Next, go over all the wiring harnesses to see if there are crispy spots No rub spots, loose areas are tolerated. Next check the chassis air supply system to be sure the customer has been draining the air tanks nightly and servicing the air dryer every 6 months with a fresh COALESCING type air dryer cartridge. This DPF system cannot tolerate ANY water or oil moisture at all for it to function correctly and reliably. Repair any leaks, electrical and air system issues before starting to dig into the Aftertreatment system. Use the US07 Spark Assist Check Sheet here to compare sensor and component values during fault tracing for spark assisted regeneration troubleshooting. Please refer to the reference documentation below. • TRU Regen Design and Function • EMCON System Training Overview
Solution visibility	Dealer distribution

Function(s)/component(s) affected

Function affected	EECU , MID 128 – EMS , MID 177 – EMCON , MID 233 – UDS , Diagnostic

	tool , Engine , exhaust

Function Group

Function Group	258 emissions after-treatment , 281 ignition coil, spark plug, ignition cable , 284 control system, fuel supply , 2861 Engine Wiring Harness

Customer effect

Main customer effect	regeneration , diagnostics/methodology , efficiency/abnormal behavior
Fluid implicated	Air , Fuel

Conditions

Vehicle operating mode	when stationary
Frequency of occurrence of problem	always

Administration

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DPF Regeneration Companion Sheet (SPN4094 v1730.7)

Spark Assist (Mack only US07)

Before starting diagnosing Regen issues with this system, a thorough investigation of the condition of the complete chassis needs to be done.

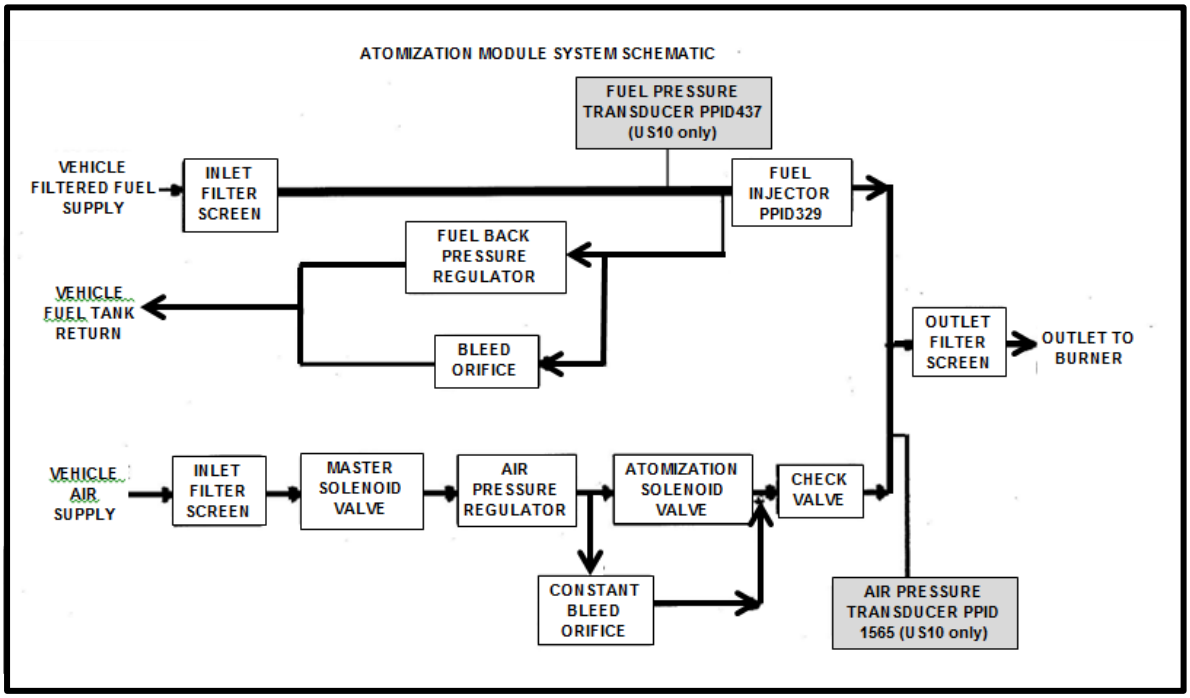
- Has the **Chassis Air System** been serviced correctly base on published service information? If not, correct the issues. The air dryer needs to be properly connected and the filter serviced with a recommended **Coalescent** cartridge. The pressure in the system needs to be regulated within the correct tolerances. If the dryer system comes in by-passed or inoperative, the air tanks and lines supplying the aftertreatment system may need to be cleaned out. Otherwise, the Air Atomization Module (even a new replacement) will not last at all.
- Has the fuel system been serviced correctly based on published service information? If not, inform the operator that the fuel system needs to be serviced.
- Is the engine air filter flowing correctly and not plugged? If not, inform the operator that the filter needs to be serviced.

Combustion Air Flow. 400+ LPM is required during Regen with idle set to 700 RPM for US07.

- **US07** - The CAV has an arrow on it to show direction of flow. The orifice in the intake manifold should be 3/8". There should be NO orifice at all in the CAV fitting boss at the combustor housing.
  - There have been reported instances of replacement US07 combustor housings that had the US10 9/32"orifices in place at the Combustion Air inlet port of the Combustor Housing. Inspect new replacement Combustor Housings for an orifice.

Typically, the Spark Assist system will complete a **Service** Regen even when there is NO combustion air flow. It will only display Flame Temp readings of only around 1700*F where proper flame temperature is normally at 1850 – 2100*F. There is typically enough oxygen remaining in the exhaust stream to support combustion under Service Regeneration conditions. This has fooled many in the past giving the impression of successful Regens but when under load, on the road, the oxygen from the engine is all used up by the engine combustion process and Regens will fail under load. So it needs Combustion Air under these conditions to support successful combustion.

Note that any leaks in the intake or exhaust systems will cause issues. The best way to inspect for and diagnose leaks is with the smoke test machine. Repair all leaks before proceeding.



Air Atomization Module (AAM) flow chart

Fuel Supply System

100 PSI **fuel pressure** Nominal. Range is 95 to 105. 95 psi is at the extreme low limit. 94 or less will give you reliability issues. The fuel pressure is controlled by the Atomization Module (AAM) and not the pump.

- If fuel pressure is low, remove the fuel return line from the AAM to the fuel tank and look for the amount of return with the engine running and pump active. Remove the AAM return line at the fuel tank return tee and cap the tee.
- LOW fuel pressure – LOW return flow indicates a bad pump or restriction from the engine supply to the pump inlet.
- LOW fuel pressure – HIGH return flow indicates the pressure control valve in the AAM is stuck open.
- Another indication of the Atomization Module dumping fuel on the **US07** engine platform, is in engine pressure sensor values during a Regen, fuel pressure lower than 40 psi, engine load higher than 15% and slightly lower boost pressure. These are indications of fuel starvation. This is more important on the **US07** engine platform because the Atomization Modules in this platform do not have pressure sensors and the Regens are done at idle.
- ***Note: In some cases, drops in engine power have been reported when the system goes into auto Regens while driving. In most of these cases, the issue is engine fuel***

starvation due to the Atomization Module pressure control valve stuck open and dumping fuel pressure. The engine fuel pump cannot keep up with the engine* and *DPF fuel demand with this condition, and the fuel pressure drops.

- HIGH fuel pressure – LOW flow indicates a blockage in the Atomization Module or the return line. Test the return flow again at the return fitting at the Atomization Module this time. If flow returns to normal, the issue is a blocked return line. If the flow remains low with high fuel pressure, the issues is a blockage within the Atomization Module.

Air Supply System

120 PSI air system air pressure to the AAM Nominal. 100 to 130 PSI is acceptable.

- Less than 100 PSI will cause issues. Pressures over 135 will cause issues. If the pressure is OK stationary (no Regen), and drops during Regen, there is a restriction in one of the lines, or a sticking pressure protection/supply valve, or a valve installed incorrectly, or the air supply was modified by the body builder (we have seen air taken from the wrong tank). The air system actually does not take all that much air. Atomization air is restricted through the orifices in the nozzle and the flow should decrease as fuel is injected (sharing the same holes).
- On the US07 system the Supplemental Air Valve should only activate momentarily on the initial system test (1 or 2 seconds) then remain off for a Service Regen.
- When checking the fuel spray pattern at the nozzle, with Atomization Valve active and Injector control active, you should have a heavy white fog. Not a stream of fuel and not a light mist.

Spark Ignition System

- When checking for spark quality, it should be checked during an active Regen command, not with the Tech Tool test. For some reason, when tested with the Tech Tool, the pulse rate is lower (longer coil charge time) than it is during an active Regen. A good test tool to have handy is a straight in-line spark tester (the style with the light bulb and **not** the open gap type). Auto parts supply stores typically sell these for about $7.00.

General Electrical

- On the US07 system, it is recommended to monitor the Emcon module Battery and Ignition voltage during the system test period when all components are turned on and again during an active Regen.
- There should be no voltage drop at all compared to the battery voltage. The wires from fuses 54 and 64 are adequate but marginal and it does not take much of a resistance problem in the wires to cause Regen issues.

- 54 is the Battery power and 64 is the Ignition power. 54 goes from the FRC connector pin C7 to the 102 pin connector pin 5, to CDPF connector pin B, and finally to the Emcon A connector pin A1.
- 64 goes from FRC connector pin A3 to the 102 pin connector pin 78, to the CDPF connector pin F, and finally to the Emcon A connector pin A3.

Note that on the US07 the Emcon module will NOT log a fault for open circuits (FMI 5) on the CAV circuit. This circuit is shared with the Atomization Air Valve. If you get an open circuit on any of these circuits individually, the other component will take up the load and the module cannot detect the open circuit condition.

1	Time	Accelerator pedal position, % - PID 91 (%)	Engine speed - PID 190 (r/min) **SHOULD BE STEADY 700+/- .5 RPM**	Vehicle speed - PID 84 (mph)	Engine load, % - PID 92 (%)	Output torque - PID 93 (ft/lbs)	Extended boost pressure - PID 439 (psi) **NORMAL REGEN BOOST SHOULD BE 3-3.5 PSI IN ORDER TO MAINTAIN 400 LPM CAV FLOW**	Intake manifold temperature - PID 105 (°F)	VGT motor effort - PPID 88 ()	VGT position - PPID 307 ()	Turbocharger #1 Speed - PID 103 (r/min)	EGR valve 1 position - PID 27 (%)	Recirculated Engine Exhaust Gas Diff Pressure - PID 411 (psi)	EGR mass flow - PPID 35 ()	EGR Temperature - PID 412 (°F)	Exhaust gas temperature - PID 173 (°F)	After-treatment regeneration flame temperature - PPID 440 () **NORMAL FLAME TEMP SHOULD BE 1850 - 2100°F THIS INDICATES CORRECT FUEL/AIR MIXTURE**	Exhaust gas temperature sensor #2 - PPID 387 ()	Exhaust gas temperature sensor #3 - PPID 436 ()	Soot Level - PPID 326 ()	Particulate trap differential pressure - PID 81 (psi)	Fuel supply pressure - PID 94 (psi)	Aftertreatment fuel injector - PPID 329 ()	Engine coolant temperature - PID 110 (°F)	Estimated Percentage Fan Speed - PID 26 (%)
1409	629.6	0	700	0	25.5	119.93	3.24	137	-42	8	44 000	0	0.105	0	191.5	481	1 892.5	1 223.2	1 069.0	7	0.1716	41.5	15.5	199	12.8
1410	630.6	0	700	0	25.5	119.93	3.222	137	-42	8	44 000	0	0.105	0	191.5	481.5	1 892.5	1 220.5	1 069.0	7	0.1716	41.5	15.5	199	14.8
1411	631.5	0	700.25	0	25.5	119.93	3.222	137	-42	8	44 000	0	0.108	0	191.5	481.5	1 892.5	1 220.5	1 071.7	7	0.1716	41	15.5	199	14.8
1412	632.5	0	700.25	0	25.5	119.93	3.222	137	-42	8	44 000	0	0.104	0	191.5	482	1 893.0	1 220.9	1 072.2	7	0.1716	42	15.5	199	14.4
1413	633.4	0	700	0	25.5	119.93	3.222	137	-42	8	44 000	0	0.105	0	191.5	484.5	1 889.6	1 220.5	1 071.7	7	0.1716	41	15	199	14
1414	634.4	0	700	0	25.5	119.93	3.24	137	-42	8	44 000	0	0.105	0	191.5	481.5	1 895.6	1 220.5	1 069.0	7	0.1716	41.5	15.5	199	13.6
1415	635.4	0	700.5	0	25.5	119.93	3.24	137	-42	8	44 000	0	0.105	0	191.5	481.5	1 895.6	1 220.5	1 069.0	7	0.1471	42	15.5	199	14
1416	636.3	0	700.25	0	25.5	119.93	3.24	138	-42	8	44 000	0	0.105	0	191.5	482	1 889.6	1 220.5	1 069.0	7	0.1716	41.5	15.5	199	14.4
1417	637.3	0	699.25	0	25.5	119.93	3.24	138	-42	8	44 000	0	0.104	0	191.5	484.5	1 886.7	1 220.5	1 069.0	7	0.1716	42	15	200	14
1418	638.2	0	700.25	0	25.5	119.93	3.24	138	-42	8	44 000	0	0.108	0	191.5	481.5	1 886.7	1 220.5	1 069.0	7	0.1471	41	15	200	14.8
1419	639.2	0	699.75	0	25.5	119.93	3.24	138	-42	8	44 000	0	0.105	0	191.5	481.5	1 886.2	1 217.7	1 068.4	7	0.1716	41.5	15	200	15.2
1420	640.2	0	701	0	25.5	119.93	3.276	138	-42	8	44 000	0	0.105	0	191.5	482	1 889.6	1 217.7	1 069.0	7	0.1716	41.5	15	200	16
1421	641.1	0	700	0	25.5	119.93	3.24	138	-42	8	44 000	0	0.108	0	191.5	481.5	1 892.5	1 217.7	1 069.0	7	0.1716	41	15.5	200	17.6
1422	642.1	0	700.5	0	25.5	119.93	3.258	138	-42	8	44 000	0	0.107	0	191.5	481.5	1 889.6	1 217.7	1 069.0	7	0.1716	42	15.5	200	16.8
1423	643.1	0	699.75	0	25.5	119.93	3.24	138	-42	8	44 000	0	0.107	0	191.5	481.5	1 889.6	1 217.7	1 069.0	7	0.1471	42	16.5	200	18.4
1424	644	0	698.75	0	26	119.93	3.222	138	-42	8	44 000	0	0.105	0	191.5	482	1 890.0	1 218.0	1 069.3	7	0.1716	41	15.5	200	18
1425	645	0	700.5	0	25.5	119.93	3.222	138	-42	8	44 000	0	0.107	0	191.5	481.5	1 892.5	1 218.0	1 071.7	7	0.1716	41	15.5	200	17.6
1426	646	0	700	0	25.5	119.93	3.222	138	-42	8	44 000	0	0.105	0	191.5	482	1 890.0	1 218.0	1 069.3	7	0.1716	42	15.5	200	19.2
1427	647	0	700.5	0	25.5	119.93	3.24	138	-42	8	44 000	0	0.105	0	191.5	482	1 890.0	1 217.7	1 072.2	7	0.1716	41	15.5	200	20.8
1428	647.9	0	699.75	0	25.5	119.93	3.222	138	-42	8	44 000	0	0.105	0	191.5	481.5	1 884.1	1 218.0	1 069.3	7	0.1716	41.5	15.5	200	20.4
1429	648.9	0	700.25	0	25.5	119.93	3.24	138	-42	8	44 000	0	0.105	0	191.5	482	1 887.1	1 218.0	1 069.3	7	0.1716	41	15.5	200	20.8

US07 Typical Service Regen with good result

US07 EMCON -- FAILED REGEN CHECK SHEET (W1949.1)

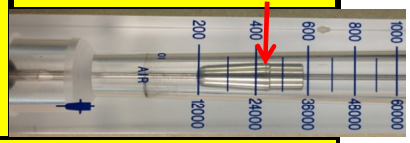
CHASSIS MODEL AND SERIAL NUMBER	CASE NUMBER

1	SMART SWITCH INHIBITTED?	Y	N

2	FAULT CODES LOGGED	MID	PID	SID	PPID	PSID	FMI	OCCURANCES
3								
4								
5								
6								
7								

CLEAR ALL FAULTS AND CONTINUE

GUIDED DIAGNOSTICS SYMPTOM-BASED DIAGNOSIS FOR THE FOLLOWING STEPS

19	IDLE SPEED SET TO?		**RPM**	**SHOULD BE SET TO 700 RPM**	
20	MID 177 SW PART NUMBER **21429010** OR HIGHER?	Y	N	If the MID177 cannot be read J1587 wire may be removed per FSB258-011	
21	DP SENSOR HOSES PER SB 234-020?	Y	N		
22	TEMP SENSORS CORRECTLY INSTALLED	Y	N		
23	**C**ombustion **A**ir **V**alve CORRECTLY ORIENTED AND NO LOOSE FITTINGS OR CONNECTOR	OK	NOK		
24	CAV FLOW with engine running and CAV activated		**LPM**	TOOL PART NUMBER 85112577 *DWYER VFC-132-EC CAN BE SUBSTITUTED*	**READ THE SCRIBE LINE IN THE MIDDLE OF THE BOBBER** 
	CAV FLOW with the outlet of the toot to ATMOSPHERE		**LPM**		
25	SPARK OBERVED IN NOZZLE HOLE (circle one)	STEADY	INTERMITTENT	NONE	**See FSB258-011 but do NOT activate the coil with the wires removed**
26	IF NO SPARK OR **NOT** STEADY - REMOVE 1 SPARK PLUG WIRE FROM THE COIL, INSTALL AN IN-LINE SPARK TESTER BETWEEN THE COIL AND THE WIRE AND TEST AGAIN TO SEE IF THE BULB LIGHTS UP	STEADY	INTERMITTENT	NONE	

27	FUEL LINES CORRECTLY INSTALLED?	Y	N	
28	FUEL PRESSURE INTO THE ATOMIZATION MODULE		PSI	Engine Running - Regen Activated - Fuel Valve and Pump Active
	If fuel pressure is lower than min spec in GD (95 psi) - how much fuel is returning to the tank from the Atomization Module?			
		NONE	A LITTLE	A LOT
	(If NONE) FUEL PRESSURE INTO FUEL SHUT OFF		PSI	Per GD instructions
	(If system pressure) VOLTS AT FUEL PUMP/VALVE		VOLTS	

29	FUEL SPRAY PATTERN (CHECK ONE)	FUEL STREAM			
		NO FUEL			
		WHITE FOG			
	AIR PRESSURE INTO THE ATOMIZATION MODULE		PSI		
30	FUEL NOZZLE AIR PRESSURE		PSI	KEY OFF	
	FSB258-012		PSI	KEY ON - ENGINE RUNNING (master air valve on)	
				NOTE: over 12 psi requires nozzle replacement	
			PSI	KEY ON - ENGINE RUNNING - MASTER AIR VALVE & CAV ON	
				Note: During active Regen, Nozzle pressure should be around 60 psi	
				Note: CAV and Atomization valve open with the same button	

31	DPF DP READING KEY ON - ENGINE OFF		PSI	
32	DPF DP READING AT IDLE		PSI	
33	DPF DP READING AT HIGH IDLE		PSI	
34	DPF DP READING UNDER HARD ACCEL		PSI	
35	FLAME TEMP DURING SERVICE REGEN		DEGREES F	
36	BOOST PRESSURE DURING SERVICE REGEN		PSI	
37	EGR DIFF. PRESS. KEY - ON ENGINE OFF		PSI	

THIS NEXT SECTION IS ONLY TO BE FOLLOWED IF THE SYSTEM DISPLAYS CONDITIONS OF EXTREMELY FAST SOOT RATIO INCREASE AND CHRONIC COMPLAINTS OF HIGH REGEN DEMAND

38	WITH INLET PIPE OFF OR FILTER REMOVED SMOKE LEVEL TRANS IN GEAR - OPERATING ARM (CIRCLE ONE)		SLIGHT HAZE	SOME BLACK	FREIGHT TRAIN BLACK
	DIAGNOSTICS FOR 'FREIGHT TRAIN BLACK'				
39	WITH EGR VALVE UNPLUGGED STILL SMOKES??		YES	NO	
40	IN NO - DOES EGR DIFF PRESS READING GO UP AND DOWN IN EGR FUNCTION TEST??		YES	NO	
41	IF NO TO ABOVE DISASSEMBLE THE EGR COLD SIDE PIPE - UNPLUG EGR VALVE AND FEEL FOR FLOW AT IDLE - FEEL FLOW??		YES	NO	
42	IF NO TO ABOVE REMOVE EGR DIFF PRESS SENSOR - TUBES - BLOCKS AND INSPECT FOR RESTRICTIONS - LEAKAGE - O-RING INTEGRITY		RESTRIC-TIONS	LEAKAGE	OK
43	IF EGR SYSTEM OK - CUT OUT CYLINDERS WITH VCADS TO SEE IF THE SMOKE GOES AWAY WITH ANY CYLINDER CUT OUT		DOES NOT CLEAR	CLEARS	

	THIS SECTION TO BE FILLED OUT IF THE SYSTEM IS LOGGING ACTIVE PSID 249 FMI 9 FAULTS				
	Manually input MID 128 PSID 57 FMI 4 in Guided Diagnostics for tools and connections for 43, 44, 45				
44	VOLTAGE AT EMCON 18 PIN / PIN A1*			VOLTS	
45	VOLTAGE AT EMCON 18 PIN / PIN A2*			VOLTS	
46	VOLTAGE AT EMCON 18 PIN / PIN A3*			VOLTS	
	* FOR 5 SECOND WHEN KEY IS FIRST CYCLED ON - this will load the circuit during the self test				

PART		Check appropriate box: REPLACED	NOT REPLACED	INSPECTED
EMCON				
NOZZLE				
DPF DP SENSOR				
FILTER				
ELECTRODES				
INLET TEMP SENSOR				
FLAME TEMP SENSOR				
PRE-FILTER TEMP SENSOR				
OUTLET TEMP SENSOR				
EMCON MODULE				
ATOMIZATION MODULE				
FUEL PUMP				
FUEL SHUT OFF VALVE				
EMCON HARNESS				
CJB				
COMBUSTION AIR VALVE				
J1587 DISCONNECTED?	**Y / N**			
ENGINE				
EGR DP SENSOR				
EGR VALVE				
CHECKED INTAKE SYSTEM FOR LEAKS	**Y / N**			
EGR DP TUBES				
VENTURI				
INJECTOR(S)				
INJECTOR PART NUMBERS				
BOOST PRESSURE/TEMP SENSOR PART NUMBER				
MID 128 REPROGRAMMED	**Y / N**			
MID 177 REPROGRAMMED	**Y / N**			

Mack US07 EMCON Diagnostic Supplement

System Overview

Mack DPF Terminology and Definitions

After-treatment system (ATS) - refers to all components that assist in meeting exhaust emission requirements. (examples: EGR valves, DPF system, DOC, DPF sensors (delta P, T), DPF injectors/doser, etc.)

Active regen – process of removing trapped particulate matter from diesel particulate filter by raising the exhaust temperature within the filter

Automatic regeneration - regeneration which has automatically been initiated by the DPF system. This occurs when all DPF criteria has been met and the systems is capable is performing the regen without fault

Moving regen – automatic regen while the vehicle is being driven (not parked)

DPF Status Lamp – this lamp is displayed to indicate to the operator the need or urgency for regen. This light is built into the blue DPF switch

HEST lamp – high exhaust system temperature lamp

Inhibit - an operator act to proactively prevent the initiation of an automatic regeneration or to intervene and stop an in-process regeneration event

Manual regen – regeneration event requested by operator

Service Regen – manual regen performed with the Vcads Pro service tool

Parked regen – regen while the vehicle is stationary and the parking brake engaged

Regen (blue) DPF switch – the switch used to initiate or inhibit, or prevent a DPF regeneration process. Mack utilizes a three position blue switch. Positions - neutral position, request regeneration, and inhibit regeneration

Why is a "Regen" needed?

- Diesel engine emission regulations require the reduction of diesel particulates (soot) in the exhaust system
- Exhaust gas flows into the open channels and through the filter wall and exits at the other end of the DPF / muffler housing - soot is trapped within the ports or channels of the filter
- Periodically, the collected soot must be regenerated (burned off)
- As a result of burning the soot, residual ash accumulates within the filter requiring a periodic filter cleaning or replacement
- Note: Rate of ash collection is based on oil consumption & oil ash content

Cordierite (Ceramic) Honeycomb Filter Substrate

Mack Non-Catalyzed DPF System Design and Function

The US07 DPF system is a non-catalyzed system

- No Diesel Oxidation Catalyst (DOC)
- No “Passive” regeneration is possible
- Active regeneration is required for the non-catalyzed DPF system
- 4 temperature sensors are utilized
- This system incorporates a temperature sensor measures flame temperature in the combustor housing, the other three temperature sensors have the same function as required in catalyzed systems
- Engine and DPF system sensor values are used to determine the need for a regen. The system provides automatic regenerations as needed as well as driver initiated regenerations depending upon the level of DPF filter and system status calculations

Mack Non-Catalyzed DPF System Design and Function

- The DPF control module (MID 177) for the exhaust aftertreatment system operates based on commands from the EECU.
- The EECU (Engine Electronic Control Unit - MID128) - master controller determines when regens can be initiated by the system or by driver. The system also controls when regens are stopped
- All regens can be stopped by driver intervention or if a system fault occurs.
- System initiated (automatic) regens will occur as long as the vehicle is moving
- The Vehicle must be moving above 5 MPH for 5 seconds before an auto regen will initiate
- Manual or parked regenerations require that the vehicle's park brake be applied

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Mack Non-Catalyzed DPF System Design and Function

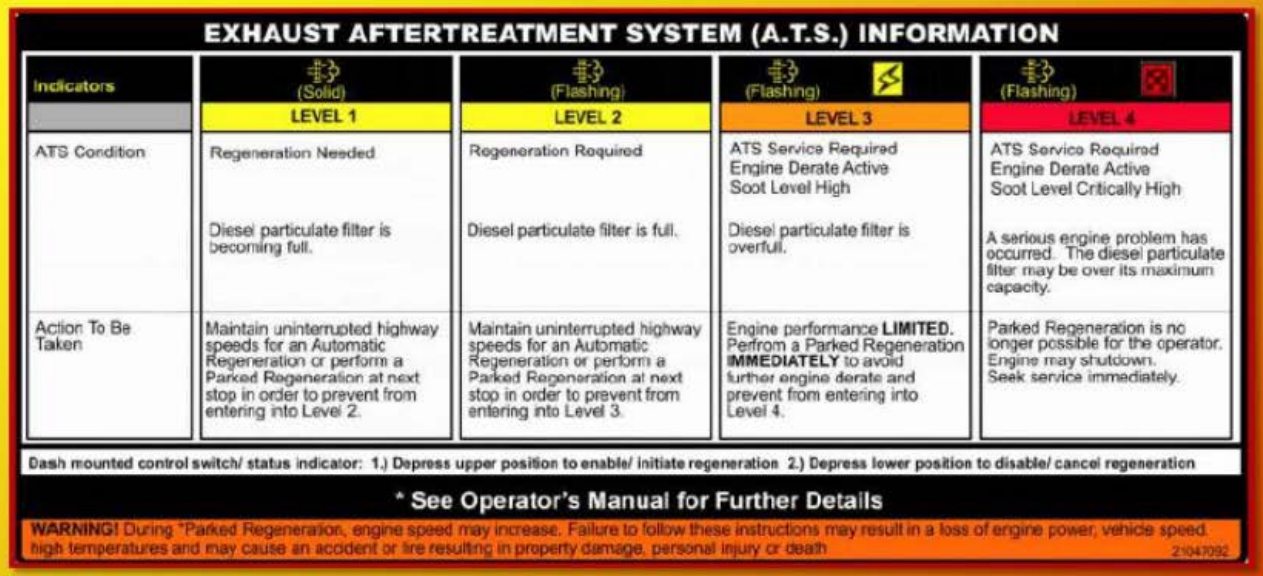
- Due to high exhaust temperatures generated by the DPF system during and after a regen, operators MUST be aware of their surroundings when operating or parking the vehicle.
- Drivers need to be aware of and look for the HEST light on dash
- If HEST light is on, this indicates the regen is active or has not yet cooled down. The vehicle must be operated or parked in a location where high exhaust temperatures will NOT pose a danger
- Regens can be stopped by turning off the ignition switch or by inhibiting the regen with the DPF (blue) switch.

DPF Instrumentation Lamps

The HEST lamp will illuminate when an automatic regen is occurring when vehicle speed falls below approximately 10 MPH. The HEST lamp turns off at approximately 500°F or if the vehicle speed is over 10 mph.
This lamp will also come on when a parked, manual, or service regen is initiated. This is to warn the driver or technician that a regen is about to take place.
Note: this lamp is only used if exhaust temperature increase is related to a regen. It will not illuminate if exhaust temp increase is related to load.

DPF Instrumentation Lamps

Mack DPF ATS Decal (located on Sunvisor)



EXHAUST AFTERTREATMENT SYSTEM (A.T.S.) INFORMATION

Indicators	(Solid)	(Flashing)	(Flashing)	(Flashing)
	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
ATS Condition	Regeneration Needed Diesel particulate filter is becoming full.	Regeneration Required Diesel particulate filter is full.	ATS Service Required Engine Derate Active Soot Level High Diesel particulate filter is overfull.	ATS Service Required Engine Derate Active Soot Level Critically High A serious engine problem has occurred. The diesel particulate filter may be over its maximum capacity.
Action To Be Taken	Maintain uninterrupted highway speeds for an Automatic Regeneration or perform a Parked Regeneration at next stop in order to prevent from entering into Level 2.	Maintain uninterrupted highway speeds for an Automatic Regeneration or perform a Parked Regeneration at next stop in order to prevent from entering into Level 3.	Engine performance **LIMITED.** Perfrom a Parked Regeneration **IMMEDIATELY** to avoid further engine derate and prevent from entering into Level 4.	Parked Regeneration is no longer possible for the operator. Engine may shutdown. Seek service immediately.

Dash mounted control switch/ status indicator: 1.) Depress upper position to enable/ initiate regeneration 2.) Depress lower position to disable/ cancel regeneration

*** See Operator's Manual for Further Details**

WARNING! During *Parked Regeneration, engine speed may increase. Failure to follow these instructions may result in a loss of engine power, vehicle speed, high temperatures and may cause an accident or fire resulting in property damage, personal injury or death

21047092

DPF Switch

The "**blue**" DPF smart switch communicates on the J1939 data link to inform the EMS and DPF systems that the driver has requested or inhibited regen. When inhibited, the all regen functions are stopped until the switch is reset.

The switch has three positions:

1. The top position is a momentary and is used to request a manual or parked regen. The regen lamp built into the switch also indicates the level of soot calculation (solid or blinking light)
2. The center position is the switch's normal operating state to allow auto regens when needed.
3. The bottom (detent locked when depressed) inhibits all regen functions. The "no regen" lamp will illuminate when inhibited.

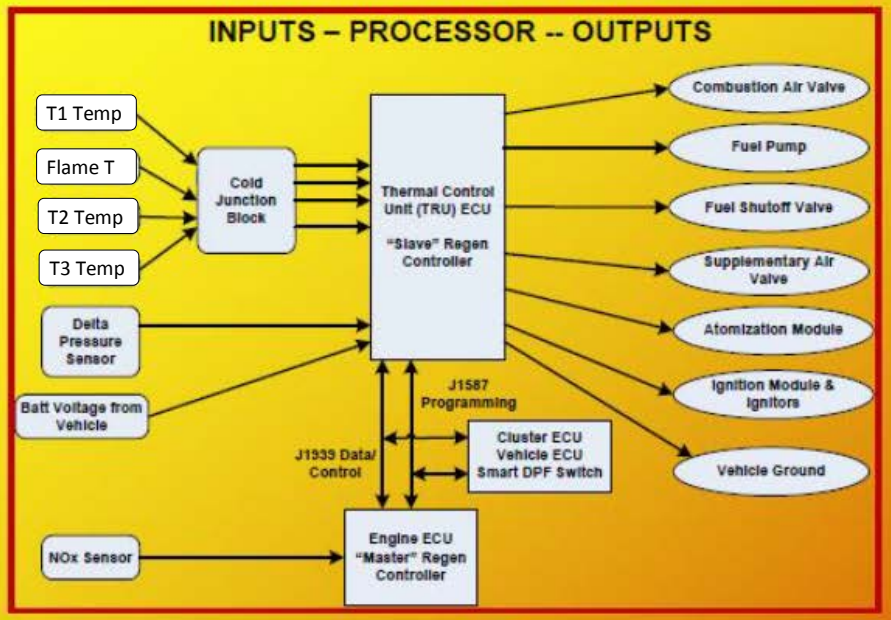
* If the DPF system is inhibited, a reset can be performed by pressing the top of the DPF switch (key on engine off) for a few seconds or by turning off the ignition key after the DPF switch has been set to the center position.

DPF Instrumentation Lamps

DPF Regeneration Levels

Soot Load Level	Level 0	Level 1	Level 2	Level 3	Level 4
DPF Status Lamp (built into regen switch)					
Cluster Display	No Warning	No Warning	No Warning	Check Engine 	Stop Vehicle 
Active Regeneration	Not Needed	Auto or Manual	Auto or Manual	Manual Parked ONLY	Off-Chassis
Engine Derate	None	None	None	Low Derate	Heavy Derate

Mack Non-Catalyzed DPF Components



This Diagram shows the electronic the DPF ECU and its input and output circuits.

Engine ECU – Determines when regens are started and when they are stopped. The DPF ECU is commanded when to start a regen and provides information on exhaust composition. The EECU also triggers the driver interface (DPF switch) and provides a gateway for diagnostic tests used in Premium Tech Tool.

DPF ECU – Controls all diagnostics and combustion (regen) in the DPF system. This ECU provides info to EECU when a regen is needed, when a regen has started, in process, has completed, and when a regen has failed.

Note: The DPF ECU will make 3 attempts at a regen before it reports a failure.

J1939 provides real-time info on TRU events and diagnostic information to the EECU.

J1587 is connected for possible programming use. Is not actually used for diagnostics.

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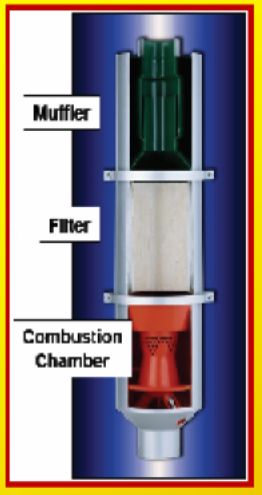
Mack Non-Catalyzed DPF Components

DPF Assembly

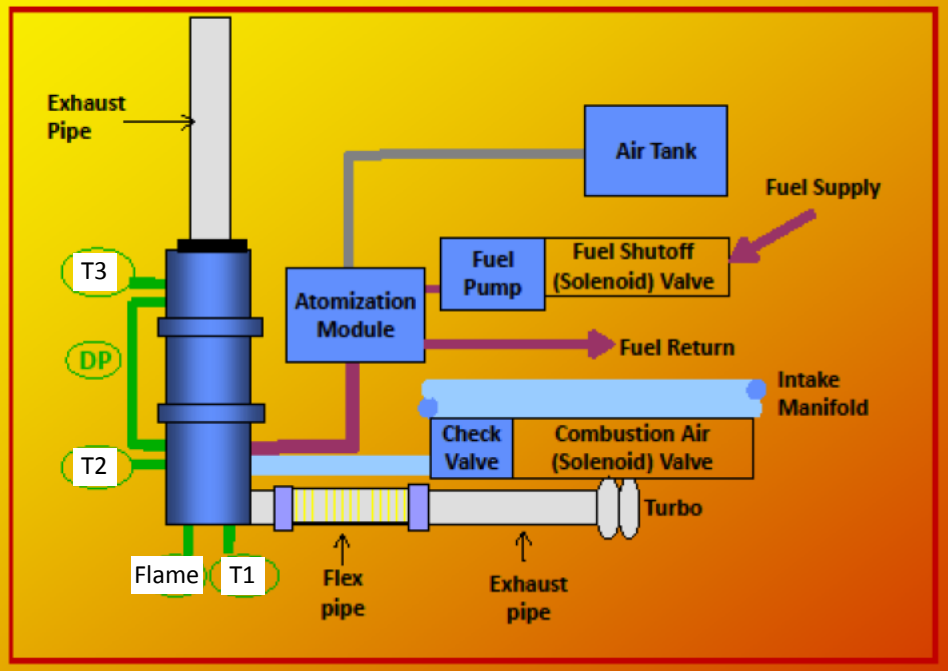


T1 Temp – Exhaust Inlet Temp (from engine into DPF)

Flame T – Flame Temp

T2 Temp – Pre- DPF filter Temp

T3 Temp – Post DPF filter Temp



T Temp Sensor

DP Delta Pressure Sensor

Mack Non-Catalyzed DPF Components

Mack Non-Catalyzed DPF Components

DPF Differential Pressure Sensor

Provides the DPF module with a pressure drop or restriction across the DPF filter

DPF Cold Junction Block

The 4 temp sensors are routed through this block and it then communicates with the DPF module

Mack Non-Catalyzed DPF Components

DPF Filter Inlet Temperature

T2 Temp

Lower DPF Differential Pressure Sensor Connection Tube

Mack Non-Catalyzed DPF Components

Upper Differential Pressure Sensor Connection Tube

DPF Filter Outlet Temperature

T3 Temp

NOx Sensor Probe

Mack Non-Catalyzed DPF Components

DPF Inlet Exhaust Temperature Sensor (T1)

DPF Flame Temperature Sensor

Mack Non-Catalyzed DPF Components

DPF Nozzle

Flow should be even from each of the holes in the tip of the nozzle. There is no cleaning process for this component. If it is plugged or not flowing properly, it must be replaced. The DPF atomization module provides a constant flow of air between **4 to 12 psi** anytime the engine is running. This helps keep the nozzle ports clean when a regen is not active. When a regen is activated and all of the requirements have been met, the pressure at the nozzle will increase to approximately **60 PSI** air pressure to atomize the fuel supplied by the atomization module.

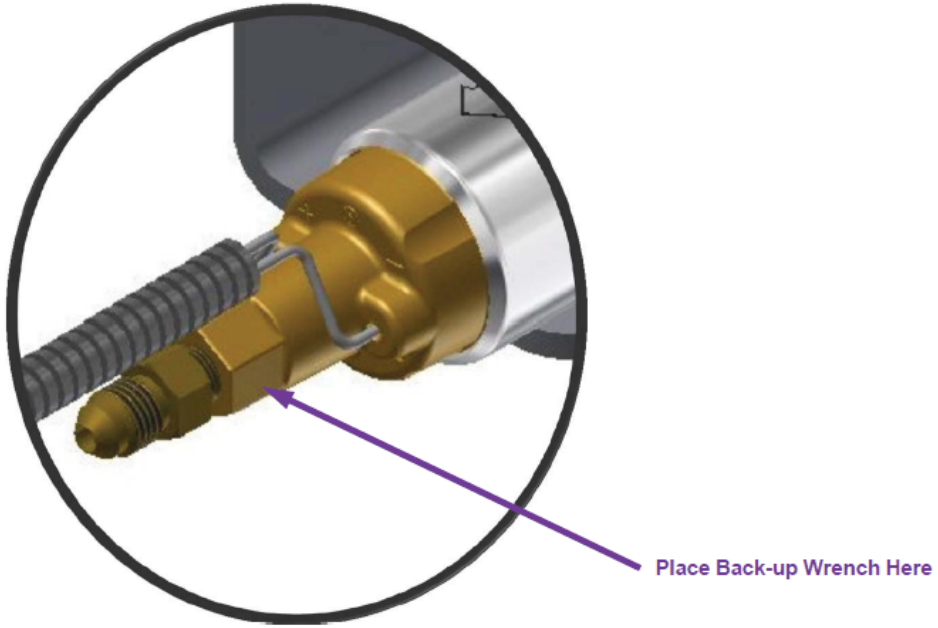
Mack Non-Catalyzed DPF Components

The DPF fuel shutoff valve is a simple solenoid-controlled on/off valve.
The DPF fuel pump is used to increase engine fuel pressure and flow to the DPF atomization module for regen flame combustion. If fuel supply pressure to atomization module is lower than 100 psi nominal, system may not function correctly. If pressure lower than 60 psi, the regen process will fail.
Both components can be operated momentarily to check function. Do NOT operate either component continuously for long periods of time as this can cause damage to the pump assembly.
The DPF fuel pump moves fuel from engine fuel gallery and supplies clean, filtered fuel at 100 psi during regeneration.

DPF Fuel Pump and Shutoff Valve Assembly

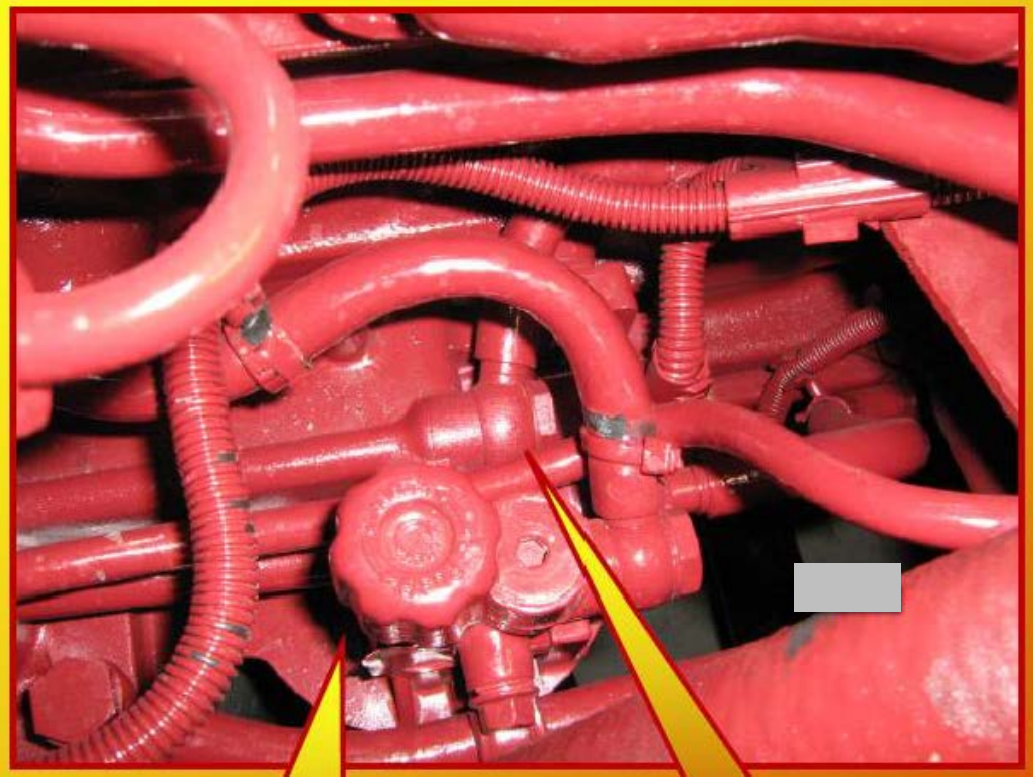
Important to Always Use a Back-up Wrench

A back-up wrench must be applied to the hex (indicated below) when installing or removing the fuel line from the pump outlet fitting. This will insure that there is no torque applied to the pump outlet itself. Application of torque, to the brass housing of the pump, will cause catastrophic failure of the pumps internal brush assembly.



Mack Non-Catalyzed DPF Components

Mack Non-Catalyzed DPF Components

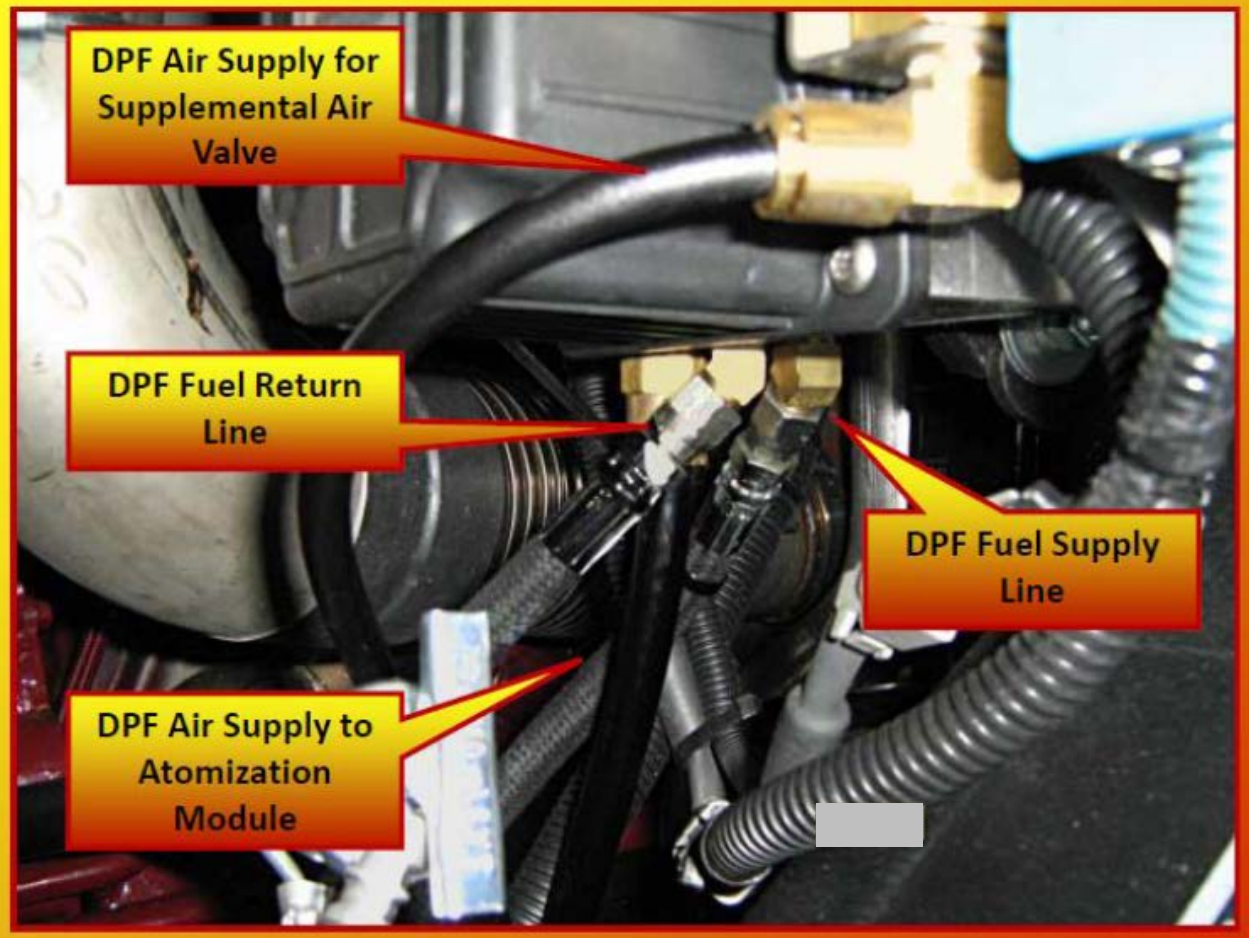


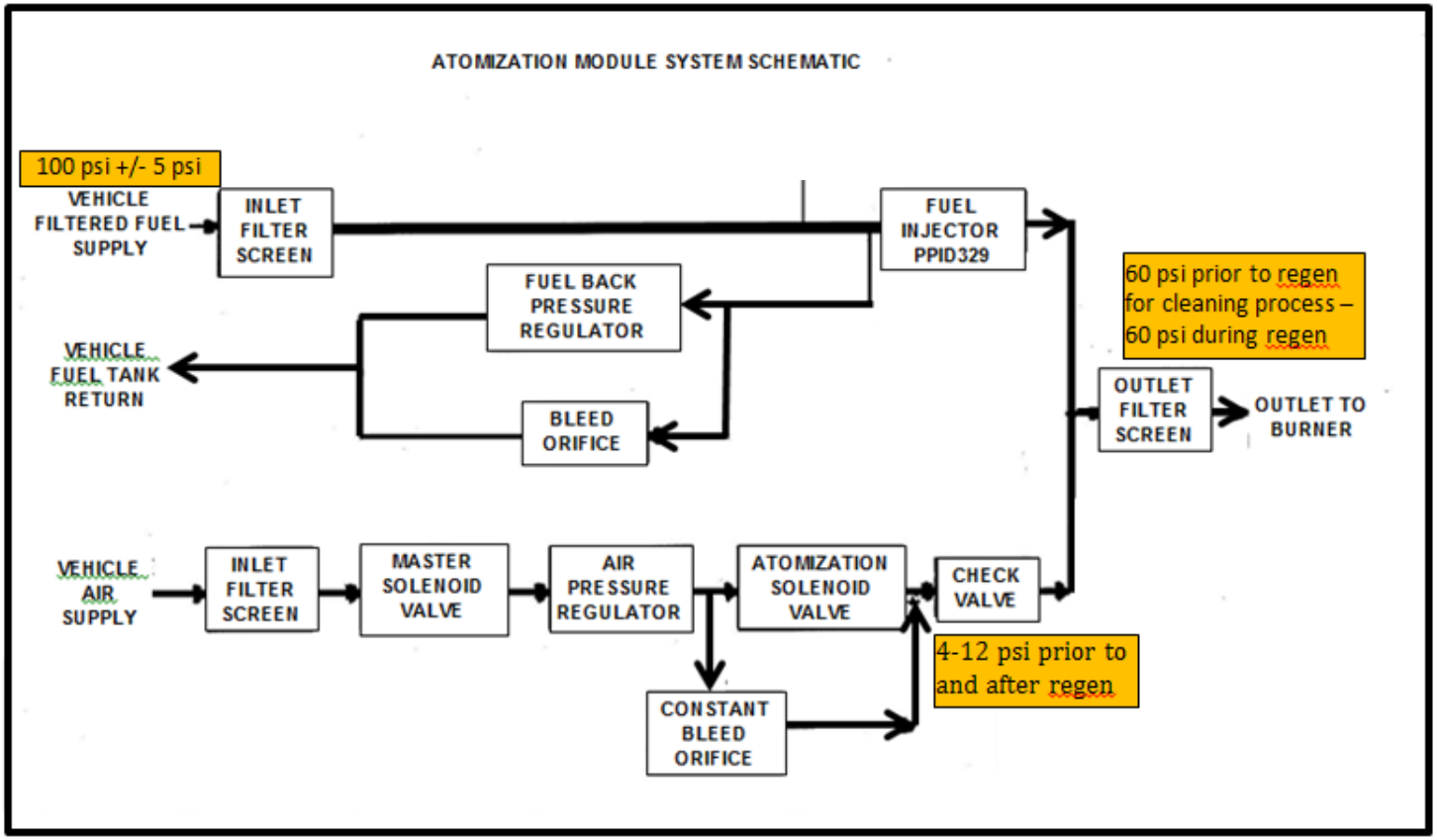
Mack Non-Catalyzed DPF Components

Mack Non-Catalyzed DPF Components

DPF Atomization Module

Mack Non-Catalyzed DPF Components





Air Atomization Module (AAM) flow chart

Mack Non-Catalyzed DPF Components

The combustion air valve is used to control main air supply to the DPF during regeneration. The CAV must be installed in this position for the system to operate properly. A regen failure will occur if this valve is installed incorrectly.

Combustion air flow at idle speed of 700 rpm (recommended)

Flow - 400 l/min

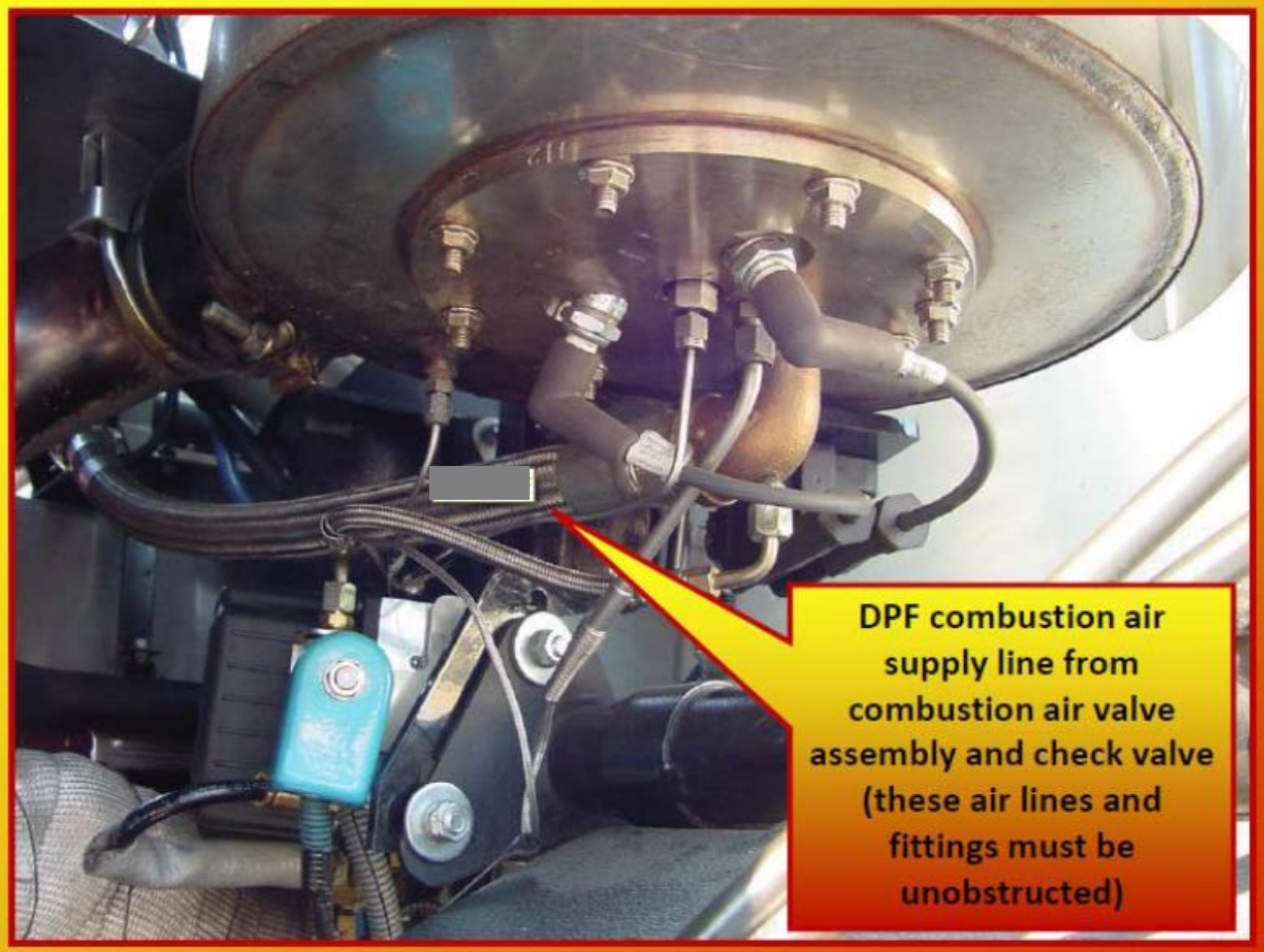
NOTE – Low DPF flame temperature can occur due to low air flow at 650 rpm idle speed

DPF Combustion Air Valve

Mack Non-Catalyzed DPF Components

The combustion air check valve is used to prevent exhaust gases from entering the intake system. This is a one-way check valve.

Mack Non-Catalyzed DPF Components

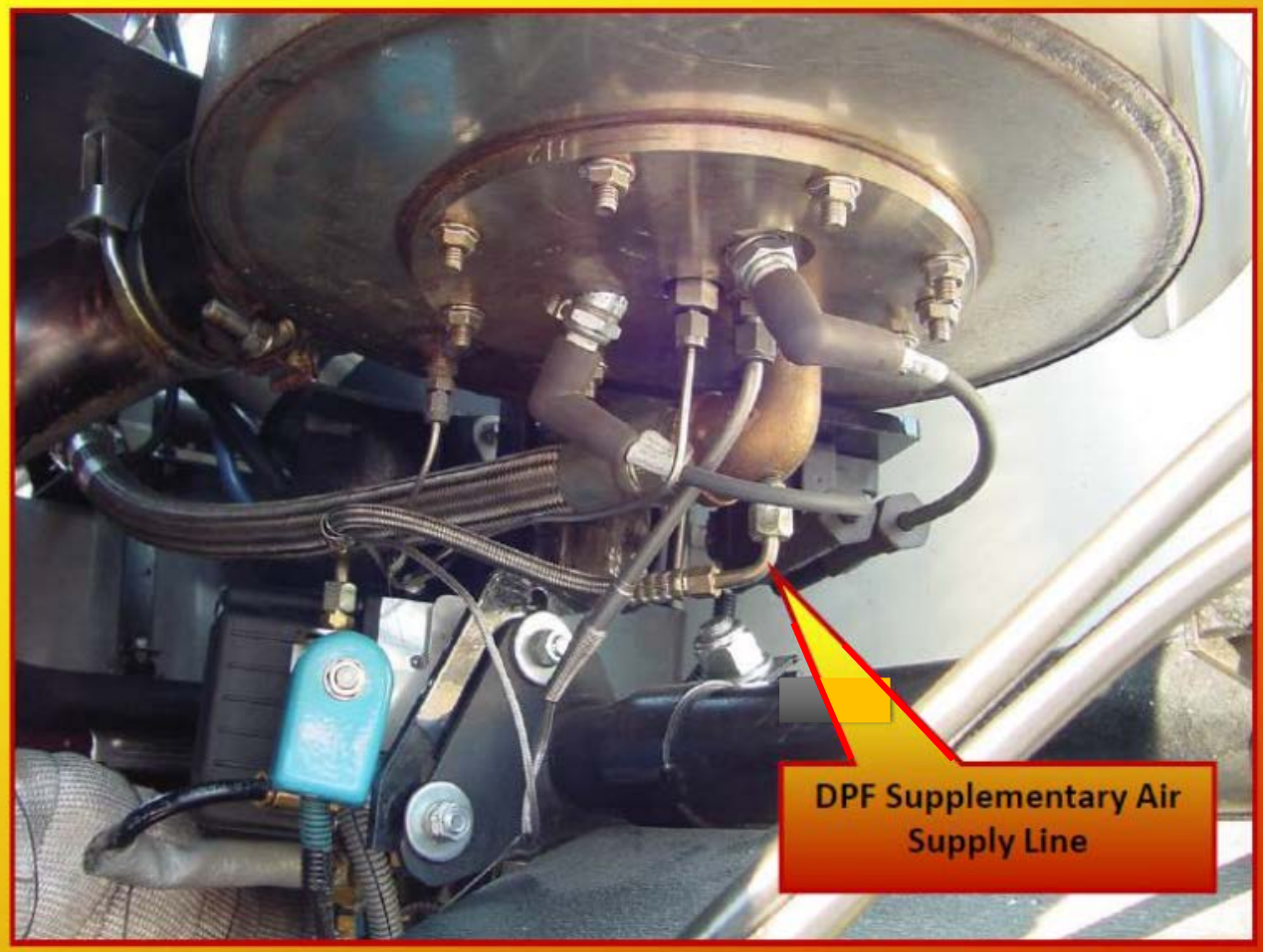


Mack Non-Catalyzed DPF Components

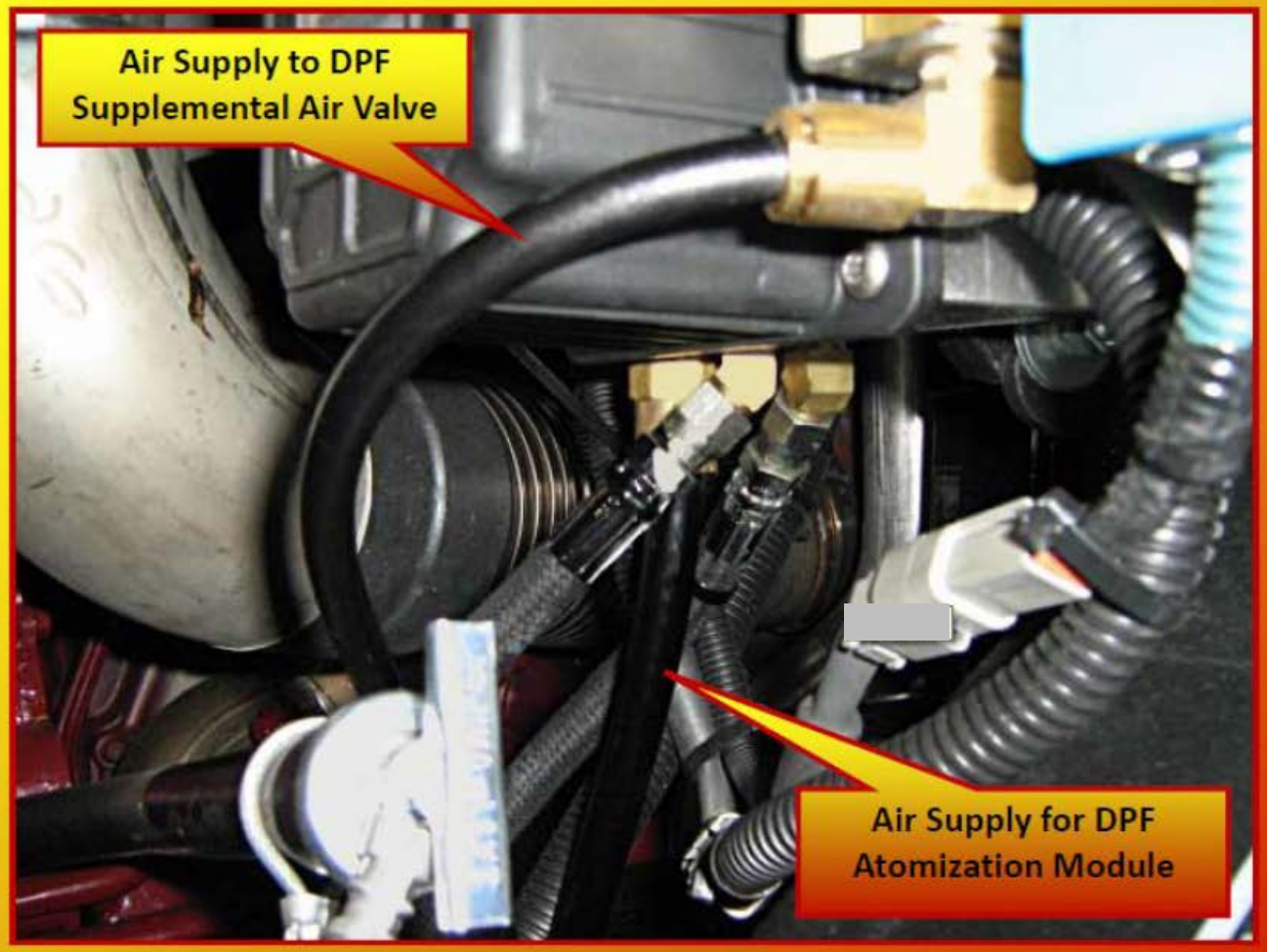
The supplemental air supply valve is used to supply system air pressure to the DPF combustion chamber during high engine demand situations. Boost pressure and air flow to the DPF system can decrease during high engine loads. This air supply helps ensure regeneration temperatures are stable and maintained.

DPF Supplemental Air Valve

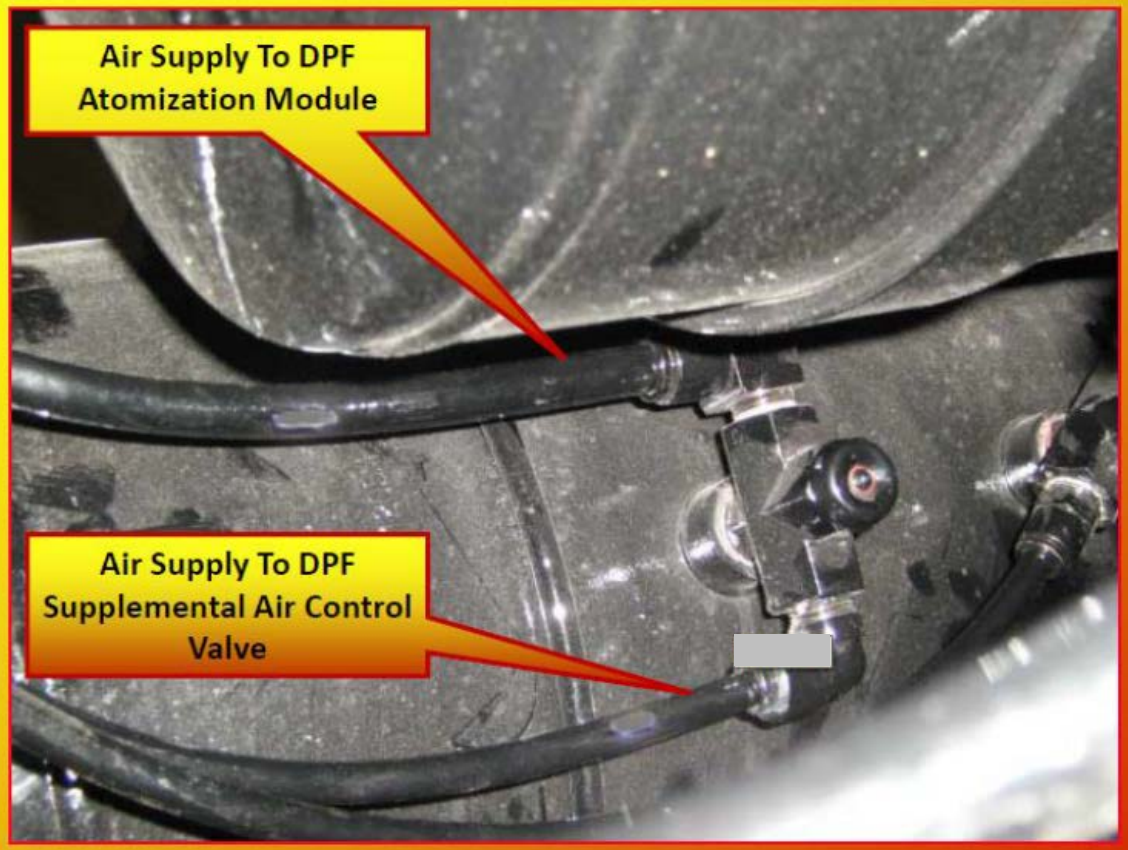
Mack Non-Catalyzed DPF Components



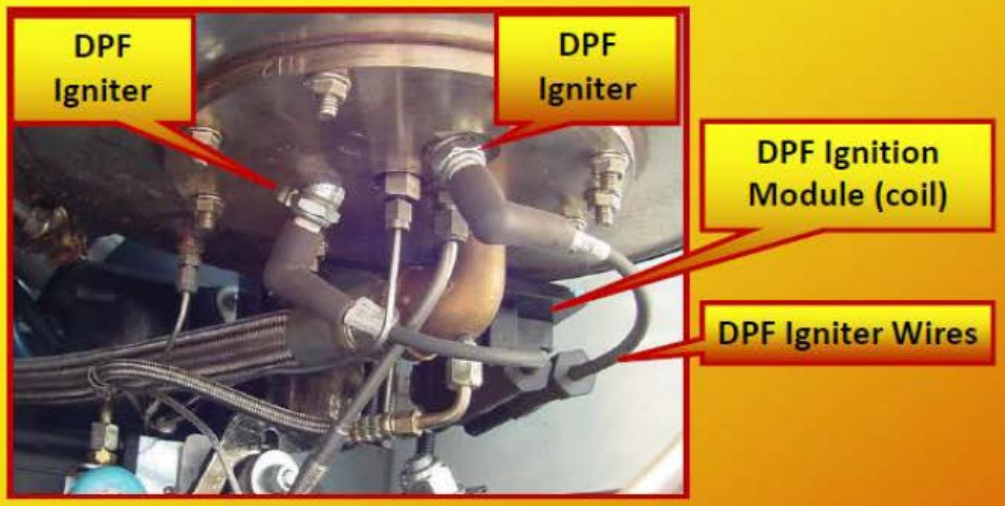
Mack Non-Catalyzed DPF Components



Mack Non-Catalyzed DPF Components



Mack Non-Catalyzed DPF Components



The DPF ignition coil is used to activate and provide spark to the DPF igniters. The coil provides an approximately 40k volts to ignite the atomized fuel in the combustor housing. With the DPF nozzle removed, the spark between the two igniters can be inspected during the first 6 seconds of key of DPF system self tests or with Vcads Pro operation tests. A igniter gap setting is not necessary and may cause damage to igniters if performed.

Mack Non-Catalyzed DPF Components