Mack Chassis - Emcon (Spark Assist) Engine Aftertreatment System Troubleshooting Check Sheet - US10 Emissions

> Internal Content

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 US10 Spark Assist Check Sheet to compare sensor and component values during fault tracing for spark assisted regeneration troubleshooting.

Please refer to the reference documentation below.

- US10 Regen Design and Function
- Combustor Inspection

Tags

SPARK ASSIST CHECK LIST

CHECKLIST

CHECK SHEET K15552222



Related links and attachments

US10 SYMPTOM BASED CHECK SHEET W2034.2

https://volvo-trkna-prod1.pegacloud.net/prweb/PRAuth/iNPUIKpeinqPJi2G0hH930k43USdE1gb*/!TABTHREAD12?pyActivity=%40baseclass.pzProces... 1/2

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US10 TRU DPF Regeneration Companion Sheet

Spark Assist (Mack only US10+6)

Before starting to diagnose Regeneration 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 the recommended **Coalescent** cartridge. The air 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 air system may need to be cleaned out. Otherwise, the Air Atomization Module (even a new replacement) will not last at all.
- An additional coalescent filter may be installed for extra protection if desired. Refer to FSB254-006 for information if the customer wants this option.
- 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 Regeneration at 1,200 RPM for US10 to attain the required 1850* to 2100* flame temperature for a good Regeneration.

- US10 The CAV (DRV style) is controlled by a solenoid mounted on the EATS rack. There is NO orifice in the intake manifold where the valve mounts. There is a 9/32" orifice in the Combustor Housing. Any leak, kinks or blockage in the small steel braided hose from the solenoid valve to the CAV will cause Regeneration failures. Any leak, kinks or blockage in the large steel braided hose from the CAV to the Combustor Housing inlet will cause Regeneration failures.
- A stuck open **EGR valve** will cause this issue.
- Some US10 combustors have been reported to have failed or had bad welds at internal components. One test is to insert an appropriately sized screw driver straight up through the 9/32" orifice hole in the combustion air inlet port and verifying there is a plate ¾" to 1 ½" up blocking the screwdriver and the plate does not move. It should be solid. This plate is actually a type of vane that directs the air in a swirling pattern within the mantle for better combustion.



- •
- Typically, the Spark Assist system will complete a Stationary Service Regeneration even when there is NO combustion air flow from the CAV. However, it will only display Flame Temp readings of only around 1700*F rather than the proper 1850 2100*F during a Regeneration. There is typically enough oxygen remaining in the exhaust stream to support combustion under stationary Service Regeneration conditions but the flame will be cool and burn rich. This has fooled many in the past giving the impression of successful Regenerations but when under load or on the road, the oxygen from the engine is all used up by the engine combustion process and moving Regenerations will fail. So, it needs Combustion Air (boost 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 diagnose these leaks is by using the smoke test machine.



Air Atomization Module (AAM) flow chart

Fuel System

100 PSI **fuel pressure** is Nominal. Allowable pressure range is 95 to 105. 95 psi is at the very low limit. 94 or less psi will cause Regeneration reliability issues. The 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 at the fuel tank tee fitting to look for the amount of return with the engine running and pump active. Cap the tee to prevent spills. It may be necessary to add a short piece of hose to the line to prevent spills.
- 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, is in the engine pressure sensor values during a Regeneration, the 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 but this time at the return fitting at the Atomization Module using a made up test line to the tank. 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 AAM.

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 (not Regenerating), and drops during a Regeneration, there is a restriction in one of the lines, or a sticking protection value at the supply air tank, or a value installed incorrectly, or the air supply was modified by the body builder (we have seen air supply 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).
- The US10 DPF system does **not** have a supplemental air valve.
- When checking the 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 Service Regeneration 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 Regeneration with the nozzle removed from the Combustor Housing using a mirror.
- 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. This tool will indicate if the coil is actually sending the high voltage signal to the igniters. If the bulb lights up, but no spark is observed in the hole, the coil should be OK but there is a spark plug wire, or igniter issue, or there is something in the combustor housing shorting out one of the igniters.

General Electrical System

On the US10 system, it is recommended to monitor the ACM Battery and Ignition voltage using the breakout box during the system test period when all components are turned on and again during an active Regeneration. There should be no voltage drop at all compared to the main system battery voltage. Battery Power is supplied by a dedicated fuse at the battery box and supplies ACM ECU supply pins 60, 61, 62. Maximum voltage drop allowed during spark ignition is 1 volt. Key switch input is supplied by fuse F69 through FRC1:A1, circuit F69A-1.0, MCFC:71 to pin 3 on ACM.

	Α	В	С	D	E	F	G	н	1	J	K		L	М	N	0	Р	Q	R	S	Т	U	V	W	Х	Y	Z	AA	AB	AC	AD	AE
1	Time	Accelerator pedal position, % - PID 91 (%)	Engine speed - PID 190 (r/min)	Vehicle speed - PID 84 (mph)	Engine load, % - PID 92 (%)	Output torque - PID 93 (ft/lbs)	Extended boost pressure - PID 439 (psi)	Intake manifold temperature - PID 105 (°F)	VGT motor effort - PPID 88 ()	VGT position - PPID 307 ()	Turbocharger #1 Speed - PID 103 (r/min)	i urbo wineei speed tilmes 100	Turke Michael theory 100	Turbochanger Compressor Outlet Temperature - PID 404	EGR valve 1 position - PID 27 (%)	Recirculated Engine Exhaust Gas Diff Pressure - PID 411 (EGR mass flow - PPID 35 ()	EGR Temperature - PID 412 (°F)	Exhaust gas temperature - PID 173 (°F)	After-treatment regeneration flame temperature - PPID	Exhaust gas temperature sensor #2 - PPID 387 ()	Exhaust gas temperature sensor #3 - PPID 436 ()	Particulate trap differential pressure - PID 81 (psi)	Soot Level - PPID 326 ()	NOx Sensor Gas Outlet - PPID 270 ()	Fuel supply pressure - PID 94 (psi)	Aftertreatment injector fuel pressure sensor - PPID 437 (Aftertreatment fuel injector - PPID 329 ()	Reagent dosage system status - PPID 1669 ()	Reagent dosage system status - PPID 1669 (adjusted)	Aftertreatment reagent pump motor - PPID 1554 ()	After-treatment Reagent Pressure - PPID 273 ()
683	450	0	1 199.75	0	29.5	300	8.91	82	10	13	68	500	685	194	C	0.13	1.38	97.8	627	1906	933	871	0.27	0	244	65	95.7	21	4232	232	32	_12
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699	470	0	1 200.75	0	26	240	8.69	82	10	13	68	000	680	194	C	0.12	1.38	98.8	626	1900	932	872	0.27	0	164	63.5	94	21.5	4231	231	32	1
700	471	0	1 200.00	0	26.5	240	8.66	83	10	13	68	000	680	194	0	0.12	1.38	98.8	624	1900	932	872	0.27	0	152	62.5	94	22.5	4231	231	32	1:
701	472	0	1 200.25	0	26.5	240	8.68	83	10	13	68	000	680	194	0	0.12	1.38	98.8	624	1902	932	872	0.27	0	152	62.5	94	22.5	4231	231	32	12
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704	477	0	1 200.25	0	26.5	240	8.68	83	10	13	68	000	680	194	0	0.12	1.38	98.8	624	1902	932	872	0.27	0	152	62.5	94	22.5	4231	231	32	12

US10 Typical Service Regeneration with good results





Example of a good Combustor housing. Note that this shows only the outer housing and not the inner mantle.

FAURECIA -- US10 FAILED REGEN CHECK SHEET (W2034.2)

	CHASSIS MODEL AND SERIAL NUMBER		ASE NUMBER		
		YES	NO]	
1	SMART SWITCH INHIBITTED?				
	FAULT CODES LOGGED	SP	N	FMI	OCCURENCES
2					

USE WITH GUIDED DIAGNOSTICS SYMPTOM-BASED DIAGNOSIS FOR THE FOLLOWING STEPS

		YES	NO			
3	ALL AIR TANKS DRAINED?					NEW
4	ANY WATER IN THE AIR TANKS?					NEW
5	IS THE CORRECT COALESCING AIR DRYER INSTALLED?			BRAND	PART #	NEW

6	WHEN WAS THE AIR DRYER LAST SERVICED? (mm/dd/yyyy)	
7	DPF FILTER PART NUMBER	

NEW

		YES	NO		
8	DPF DP SENSOR HOSES OK?				
9	TEMP SENSORS CORRECTLY INSTALLED				
10	CAV FLOW with engine running and CAV activated - checked during Regen at 1200 RPM - not idle speed		LPM	TOOL PART NUMBER 85112577 The tool may need to be tilted horizontally then slowly tilted back vertically to get a	Typically see 400+ LPM
11	PER SYMPTOM-BASED DIAGNOSTIC NEXT STEP IF CAV FLOW IS LOW - what is CAV flow with the outlet of the tool vented to atmosphere?		LPM	steady reading DWYER VFC-132-EC CAN BE SUBSTITUTED (see tool tab for details)	READ THE SCRIBE LINE IN THE MIDDLE OF THE BOBBER
	If the flow is low, check for any valve contact with the intake elbow mounti Also check for the activation of the CAV control solenoid, system supply a the CAV			check the SS braided hose for collapse - d and pressure line from the solenoid to	

		STEADY	INTERMITTENT	NONE	
12	SPARK OBERVED IN NOZZLE HOLE				REFER TO FSB 258-011 but do NOT activate the coil with the two wires disconnected
13	IF NO SPARK, WEAK SPARK OR NOT STEADY - REMOVE 1 SPARK PLUG WIRE FROM ONE OF THE ELECTRODES, INSTALL AN IN-LINE SPARK TESTER BETWEEN THE ELECTRODE AND THE WIRE AND TEST AGAIN TO SEE IF THE BULB LIGHTS UP				
NOTE: if the spark is steady but just a little weak, it may still be killed when fuel is mixture					ed and not light the fuel-air
		YES	NO		
14	ATOMIZATION MODULE FUEL LINES CORRECTLY INSTALLED?				
15	FUEL PRESSURE INTO THE ATOMIZATION MODULE		PSI	TAKEN TEED	IN AT THE ATOMIZATION INLET - NOT THE PUMP OUTLET
	-	NONE	SOME	LOTS	l
16	IF FUEL PRESSURE LOW - HOW MUCH RETURN TO THE FUEL TANK?				Some flow back to the tank is normal due to the return bleed orifice. A lot may indicate the fuel pressure regulator valve is stuck open and dumping the fuel

17	IF NONE, FUEL PRESSURE INTO FUEL SHUT OFF		PSI		From engine supply	
18	IF SYSTEM PRESSURE, VOLTS AT FUEL PUMP/VALVE		VOLTS			
		ELIEL STREAM			I	
19	FUEL SPRAY PATTERN FROM NOZZLE (mark one)	TOLLOTILLAW	NOTOLL	WIIILIOG	FUEL AND AIR TESTS ARE BEST DONE WHIL REGEN - VCADS WON'T WORK - AIR PRESSUR ATOMIZATION MODULE INLET - NOT AT TH	E STARTING A E TAKEN AT THE IE AIR TANK
20	AIR PRESSURE INTO THE ATOMIZATION MODULE		PSI	AIR PRESSURE CH	ECK USING A TEE FITTING AT THE ATOMOZATIO	N MODULE INLET
	FUEL NOZZLE AIR PRESSURE WITH KEY OFF		PSI			
21	FSB 258-012 KEY ON - ENGINE RUNNING (master air valve only activated)		PSI	N	OTE: over 17 psi requires nozzle replacemen	t
	KEY ON - ENGINE RUNNING - MASTER AIR VALVE + ATOMIZATION VALVE		PSI			
22	DPF DP READING KEY ON - ENGINE OFF		PSI			
23	DPF DP READING AT IDLE		PSI			
24	DPF DP READING AT HIGH IDLE (1800+ rpm)		PSI			
25	DPF DP READING UNDER HARD ACCEL		PSI			
26	FLAME TEMP DURING SERVICE REGEN		DEGREES F			
	If the Flame temp is eratic, verify that the air pressure to constant with the Activation soleno	the CAV is system id activated.	m pressure and			

27	BOOST PRESSURE DURING SERVICE REGEN		PSI	
28	EGR DIFF. PRESS. KEY - ON ENGINE OFF		PSI	
		YES	NO	
29	IF THE REGEN DROPS OUT SUDDENLY - DOES THE VEHICLE SPEED CONDITION DROPOUT?			NEW

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

		SLIGHT HAZE	SOME BLACK	FREIGHT TRAIN BLACK
	WITH INLET PIPE OFF OR FILTER REMOVED			
30	SMOKE LEVEL TRANS IN GEAR - OPERATING ARM			
	(CIRCLE ONE)			

	DIAGNOSTICS FOR 'FREIGHT TRAIN	BLACK'	
		YES	NO
31	WITH EGR VALVE UNPLUGGED STILL SMOKES??		
32	IN NO - DOES EGR DIFF PRESS READING GO UP AND DOWN IN EGR FUNCTION TEST??		
33	IF NO TO ABOVE DISASSEMBLE THE EGR COLD SIDE PIPE - UNPLUG EGR VALVE AND FEEL FOR FLOW AT IDLE - FEEL FLOW??		
	-	RESTRICTIONS	LEAKAGE
34	IF NO TO ABOVE REMOVE EGR DIFF PRESS SENSOR - TUBES - BLOCKS AND INSPECT FOR RESTRICTIONS - LEAKAGE - O-RING INTEGRITY		

		DOES NOT CLEAR	CLEARS
	IF EGR SYSTEM OK - CUT OUT CYLINDERS WITH		
35	VCADS TO SEE IF THE SMOKE GOES AWAY WITH ANY		
	CYLINDER CUT OUT		

Check appropriate box

	PART	REPLACED	NOT REPLACED	INSPECTED
	SPARK ASSIST			
	NOZZLE			
	DPF DP SENSOR			
	FILTER			
	ELECTRODES			
	INLET TEMP SENSOR			
	FLAME TEMP SENSOR			
	PRE-FILTER TEMP SENSOR			
	OUTLET TEMP SENSOR			
	AFTERTREATMENT CONTROL MODULE (ACM)			
36	ATOMIZATION MODULE			
	FUEL PUMP / FUEL SHUT OFF VALVE			
	DPF HARNESS			
	COMBUSTION AIR VALVE (DRV STYLE)			
	SS BRAIDED COMBUSION AIR LINE			
	COMBUSTION AIR SOLENOID VALVE			
	ENGINE			
	EGR DP SENSOR			
	EGR VALVE			
	INJECTOR(S)			
Γ	EGR DP TUBES			
	VENTURI / SENSOR / ADAPTERS			

	YES	NO
CHECKED INTAKE SYSTEM FOR LEAKS		
J1587 DISCONNECTED?		
MID 128 REPROGRAMMED		
MID 233 REPROGRAMMED		

TOOLS

REF	PART NUMBER	DESCRIPTION
10	85112577	COMBUSTION AIR FLOW GAUGE
10	DWYER VFC-132-EC	CAN BE SUBSTITUTED ***
15 / 20	85112576	TEE FITTING
15 / 20	J48925	PRESSURE TRANSDUCER
	85112578	EMCON BREAKOUT HARNESS
	85112579	BREAKOUT BOX COVER PLATE
	9998699	BREAKOUT BOX
	85112706	16 PIN BREAK OUT
	85112733	OVERLAY
	85112931	COLD JUNCTION BLOCK BREAK OUT
	9990216	BOOST SENSOR BREAKOUT BOX
	9996662	AIR PRESSURE REGULATOR
	9998538	BOOST SENSOR ADAPTER
	88890147	ATOMIZATION BREAKOUT HARNESS
13		SPARK TESTER PURCHASED LOCALLY
		TO COMPLETE THE CAFG KIT, 2 BRASS 90° ELBOW
***		WITH 1" NPT / BARB FITTING, 16" PIECE OF 1"
		HEATER HOSE AND 2 WORM GEAR CLAMPS ARE
		ALSO REQUIRED
1	1	