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Ihre Zeichen, Ihre Nachricht vom Your reference	Unser Zeichen, unsere Nachricht vom Our reference	Name	Datum/Date
		Markus Loesch	04/09/2014

Request for approval of new scheduled maintenance under §86.183401(b)(7)(ii)) for Model Year 2015 Sprinter vehicles

Dear Mr. Ball,

Mercedes-Benz kindly requests that EPA approves as new scheduled maintenance interval for the refill of DEF for the Model Year 2015 Mercedes Benz Sprinter vehicles, which are chassis certified under the Heavy Duty emission regulation.

SCR technology and the urea infrastructure have continued to develop and DEF is more broadly and readily available and more vehicle manufacturers have introduced vehicle models with SCR technology. However, the core characteristics of SCR and DEF have not changed and it continues to remain technologically necessary to replenish the SCR system with DEF at intervals shorter than 100,000 miles.
The allowable DEF refill interval should be allowed to set to shorter intervals due to space constraints with packaging of the DEF tank and due to the negative impacts to fuel economy and performance from adding weight to the vehicle.

The following is further detailed substantiation for this request:
We recommend that the maintenance category for DEF refill be emission-related, critical maintenance. We further recommend that, for Model year 2015, the technologically necessary SCR maintenance interval (i.e., DEF tank refill interval) be set to shorter intervals than the 100.000 miles service interval.

1) Reasons for why DEF refill is an emissionrelated, critical maintenance
EPA noted in CISD 07-07 that since the SCR catalyst does not function without the use of a reducing agent, 40 CFR §86.1834-01(b)(4)(ii)(F) and §86.004-25(b)(4)(iii)(F) would apply to the SCR catalyst and all of the associated hardware, including but not limited to the reducing agent, the reducing agent storage tank, the dosing valve, and all lines and hoses. We agree with EPA that DEF refill is an emission-related, critical maintenance.

2) Reasons for why the technologically necessary SCR maintenance interval should be the same as the service interval for Model Year 2015

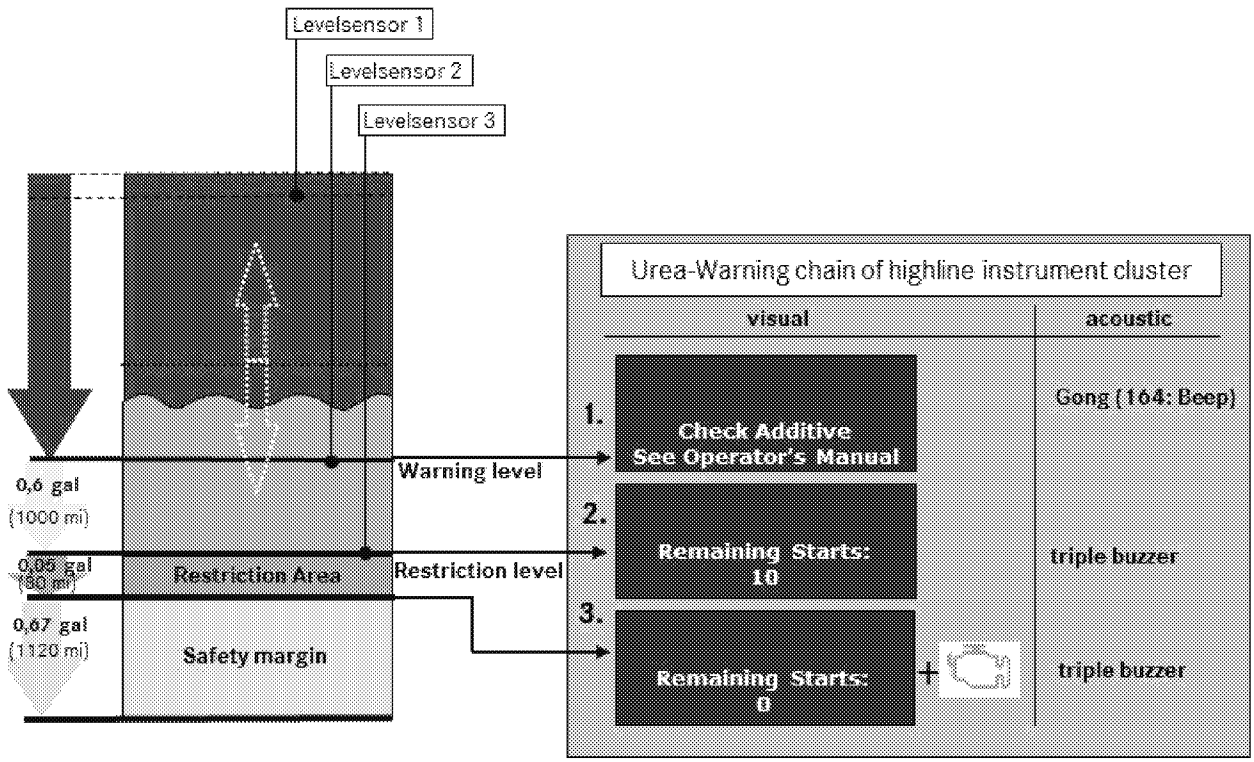
The reasons for why the technologically necessary SCR maintenance interval should be set to a lower milage as full useful live are: vehicles will be designed and equipped to ensure vehicle compliance with emission standards; DEF will be readily available and accessible to drivers; DEF maintenance will likely be performed; there are engineering constraints on packaging a large DEF tank on MDV vehicles; and there is a significant penalty on fuel economy and performance associated with carrying both a larger DEF tank and the weight of a large quantity of DEF.

a) Vehicles will be designed and equipped to ensure compliance with emissions standards

i) Driver Warning

Mercedes-Benz will equip vehicles with an escalating audible and visual warning chain that provides adequate time to re-fill the DEF. USCAR has developed a recommended practice for manufacturers to use as a standardized warning chain. This warning chain has also been adopted as an SAE industry-wide recommended practice. SAE has also standardized the DEF indicator symbol. Mercedes-Benz will use an escalating mix of DEF level indicator, messages in the instrument cluster, engine shutdown lamp, or audible warnings to warn the driver of low DEF levels.

Mercedes Benz Sprinter vehicles are either equipped with 3 level sensors in the DEF tank (for 6 cyclinder diesel engines) or a continuous ultrasonic level sensor. Based on the DEF level in the tank the following visible and audible driver warning strategy is activated:

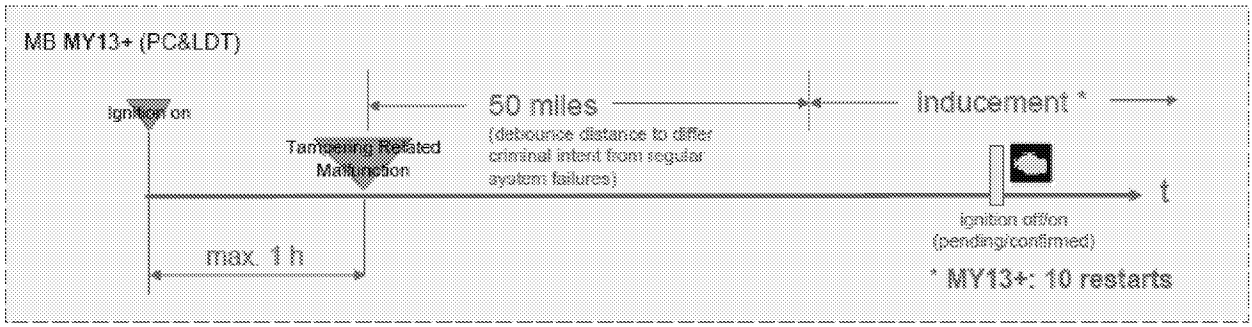


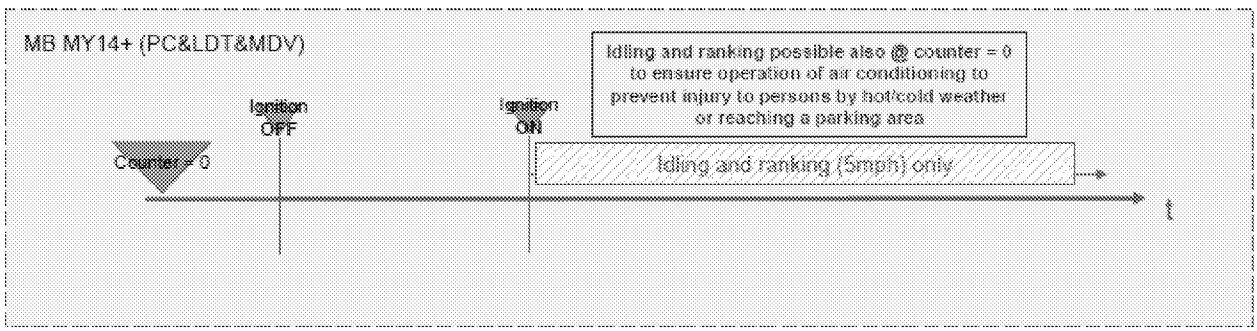
ii) Driver Inducement

Mercedes-Benz will equip vehicles with escalating and sufficiently onerous levels of inducement to ensure that the DEF is refilled. This escalating inducement also includes identification of incorrect reducing agent.

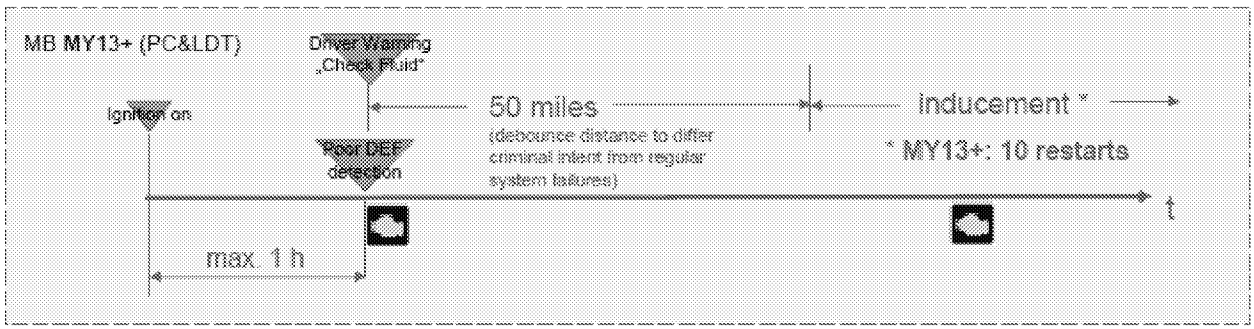
If a certain level of DEF is reached (restriction level, see picture above), the inducement is started. The remaining possible amount engine starts are displayed in the display unit and in addition a triple buzzer is used as an audible warning. Each engine restart, the counter counts down until 0 is reached. Then only idling or ranking up to 5mph is possible. The possibility of idling or ranking was installed due to safety reasons (e.g. ranking to a safe location or idling in order to keep the A/C running).

This inducement strategy is shown below:





The Mercedes Benz SCR technology can also identify a wrong medium or the dilution of the DEF. If wrong or diluted medium is identified, the following warning/restrictions are started:



iii)Tamper Resistant Design

Mercedes-Benz will design the SCR system to be tamper resistant consistent with the EPA's March 27, 2007 guidance letter. The actions listed below will trigger illumination of a warning lamp:

- Disconnected DEF tank level sensor
- Blocked DEF line or dosing valve
- Disconnected DEF dosing valve
- Disconnected DEF pump
- Disconnected SCR wiring harness
- Disconnected NOx sensor (that is incorporated with the SCR system)
- Disconnected DEF quality sensor

Below you can find an overview of Mercedes Benz diesel vehicles components or signals which lead to the illumination of the check engine light, or directly lead to the driver inducement.

System	Component	Malfunction	1 save	2 access	3 no tools	4 no expertise	tampering relevant	MIL	Inducement
SCR dosing system	Control unit	Control unit defective	yes	yes	yes	no	**no**	yes	no
	Wiring 4-port/2-way valve	Wiring defective	yes	no	yes	no	**no**	yes	no
	Functionality 4-port/2-way valve		yes	no	no	no	**no**	yes	no
	Excess temperature of pump		yes	no	yes	no	**no**	yes	no
	Wiring pump	Wiring defective	yes	no	yes	no	**no**	yes	no
	SCR fuse A	Removed fuse 1 (heater of tank)	yes	yes	yes	yes	**yes**	yes	yes
	SCR fuse B	Removed fuse 2 (pressure line supply module)	yes	yes	yes	yes	**yes**	yes	yes
	SCR fuse C	Removed fuse 3 (control unit)	yes	yes	yes	yes	**yes**	yes	yes
	Fuse SCR master relay solenoid F48_K130 (SRB Heck)	Removed fuse	yes	yes	yes	yes	**yes**	yes	yes
	Fuse SCR master relay pin F33_F81	Removed fuse	yes	yes	yes	yes	**yes**	yes	yes
	SCR master relay	Removed relay	yes	yes	yes	yes	**yes**	yes	yes
	Wiring of pressure sensor (dosing)	Wiring defective	yes	no	yes	no	**no**	yes	no
	Plausibility pressure sensor (dosing)	Stuck of pressure value	yes	no	yes	no	**no**	yes	no
	Wiring of heater, connector of tank heater	Wiring defective	yes	no	yes	no	**no**	yes	no
	Wiring of tank temperature sensor	Wiring defective	yes	no	yes	no	**no**	yes	no
	Plausibility tank temperature sensor		yes	no	yes	no	**no**	yes	no
	Wiring of tank level sensor of lower and middle urea tank level sensors	Wiring defective	no	no	yes	no	**no**	yes	no
	Wiring of tank level sensor of upper urea tank level sensor (maximum fluid level sensor)	Wiring defective	no	no	yes	no	**no**	yes	no

System	Component	Malfunction	1 save	2 access	3 no tools	4 no expertise	tampering relevant	MIL	Inducement
Tank	Reservoir	DEF-Tank leakage	no	yes	yes	yes	**no**	yes (empty tank)	yes (empty tank)
		DEF-Tank leakage (urea crawling)	no	yes	yes	yes	**no**	yes (empty tank)	yes (empty tank)
	Tank level sensor	Signals of level sensors implausible to each other	yes	no	yes	yes	**no**	yes	no
		manipulation: Removed NOx sensor with air contact and continuous refill of H2O	yes	no	no	yes	**no**	yes	no
		Manipulated sensor (always 100%)	yes	no	yes	no	**no**	yes	no
	Temperature sensor in tank	Implausible signal	yes	no	yes	no	**no**	yes	no
		Wiring defective	yes	no	no	no	**no**	yes	no
	Urea	Urea quality (too little concentration of urea) with refill event	yes	yes	yes	yes	**yes**	yes	yes
		Urea quality (too little concentration of urea) without refill event	yes	yes	yes	yes	**yes**	yes	yes
		Empty tank					**no**	yes	yes
		Frozen urea					**no**	yes	no

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iv) Freeze Protection
Mercedes-Benz will design and equip vehicles with DEF Dosing Freeze Protection Systems which will prevent or minimize SCR performance degradation due to freezing of DEF. This can include DEF tank heaters, line heaters, and location of tank within a heated space.
Mercedes Benz Sprinters are equipped with one heater in the DEF tank, one heater in the dosing line and in addition the DEF pump module is also heated. Here the coils of the pumps are used as heater.

b) DEF will be readily available and accessible to drivers
i) DEF is available at dealerships, gas stations and truck stops
Manufacturers of SCR vehicles have worked with franchised dealerships to supply DEF to their customers. Several of these manufacturers have agreements with gasoline station chains to ensure availability of DEF at those refill stations. In addition, many companies have announced publicly their intention to stock DEF.
To further ensure the quality of DEF at these retail locations, the American Petroleum Institute is administering a DEF quality control program with the support of distributor and retailer licensing agreements. (http://www.apidef.org/)

ii) An organized industrywide SCR Stakeholder Group is ensuring wide availability of DEF DEF infrastructure development is making significant progress. Industry-wide standards for DEF infrastructure, a necessary enabler for the widespread availability of DEF, have been put in place, including ISO DEF specifications, API's DEF quality standard, SAE DEF specifications, and USCAR and SAE warning chain standards. The SCR Stakeholder Group has established itself as a focal point for infrastructure development discussions by EPA, DOE, DEF producers, suppliers, distributors and users of DEF.

iii) Drivers can locate DEF through DOE's NREL locator website
DOE/NREL has established a locator website (http://www.afdc.energy.gov/afdc/locator/def/) for drivers to use to locate supplies of DEF. Over 5,000 locations are included on the locator website. Other companies are also creating DEF locator websites which will be available to the public.

iv) Public awareness of availability is increasing through DEF public relations activities
Numerous press releases and public relations activities have been distributed related to the development of DEF infrastructure. (For an up-to-date and complete list please see the Recent News & Headlines section at http://www.factsaboutscr.com/.)

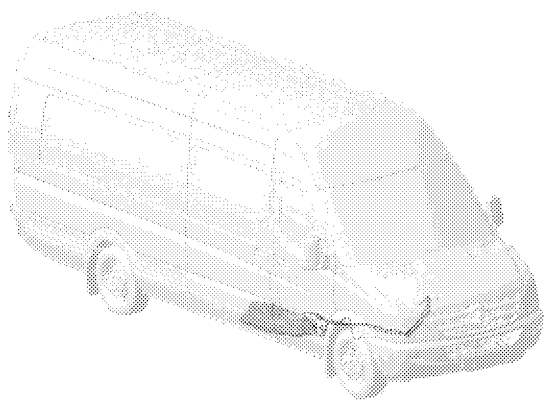
c) DEF maintenance is likely to be performed on schedule
There are a number of reasons why the DEF refill maintenance is likely to be performed. Vehicles will be quipped with an escalating warning chain which will audibly and visually signal that the maintenance needs to be performed. In the unlikely event that the warnings are not heeded and the maintenance is not performed, the performance of the vehicle will be noticeably and significantly degraded.

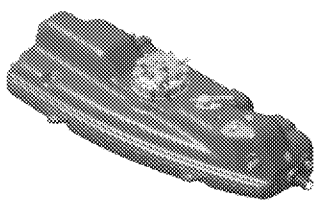
d) Engineering constraints with packaging preclude packaging of a large quantity of DEF on medium duty vehicles
It is impractical to equip medium duty vehicles with a DEF tank(s) sufficient in size to achieve the 100,000 mile scheduled maintenance requirement. The amount of space required for such a DEF quantity would make the vehicle uncompetitive and less marketable. Mediumt duty vehicles are constrained in the amount of space that can be dedicated to a DEF tank. In addition to the DEF tank, SCR vehicles must package an SCR catalyst, SCR mixer and DEF dosing and heating mechanisms. For example, a Mercedes Benz MY15 Sprinter equipped with Diesel SCR technology provides between 4.1 and 4.9 gallons of DEF which last for 4800 up to 9000 miles of

driving (depending on the variant of the vehicle). Taken that DEF consumption into account, the DEF tank size would require up to 85 gallons in order to achieve the 100.000 mile scheduled maintenance interval. The space required to accommodate such a DEF quantity would be approximately 11.5 cubic feet (85 gallons times 0.1337 gallons per cubic foot). This would also be almost equivalent to installing more than 3 extra fuel tanks (in addition to the existing fuel tank of 26.4 gallons).
In addition to the DEF tank, vehicles must also package the SCR catalyst, SCR mixer and DEF dosing and heating mechanisms. The space required for these additional catalysts and devices, as well as their packaging requirements (e.g., heat transfer requirements from the SCR catalyst), limit the locations and space available in the undercarriage for use for increased DEF capacity.

e) The fuel economy and performance penalty is significant with large DEF volume
It is impractical for medium duty vehicles to carry the weight of a DEF tank sufficient in size to achieve the 100,000 mile scheduled maintenance requirement. The addition of such a weight to a medium duty vehicle would significantly reduce the fuel economy and the performance of the vehicle.
The weight of such a DEF quantity would be 765 lbs (85 gallons times 9 lbs per gallon) using the example above. This is in addition to the weight of the actual DEF tank itself, mountings and necessary chassis or suspension reinforcements to support the increased weight. According to the EPA and DOE website Fueleconomy.gov (http://www.fueleconomy.gov/feg/lightweight.shtml), for every 10% of weight eliminated from a vehicle's total weight, fuel economy improves by seven percent. Using this ratio, the addition of 765 lbs to a 5000 lb base curb weight vehicle would reduce fuel economy by approx. 10%.
Also, the handling performance (acceleration, braking, turning) and the available passenger space, cargo carrying and/or towing capacity of the vehicle would be negatively affected. The combination of reduced fuel economy and reduced vehicle performance would result in an uncompetitive vehicle which is less marketable.
For these reasons, Mercedes-Benz requests that EPA reapprove the scheduled maintenance interval of DEF refill for chassis certified medium duty vehicles (up to 14,000 GVWR) for Model Year 2015 that coincides with the below displayed ranges for the different vehicle types:

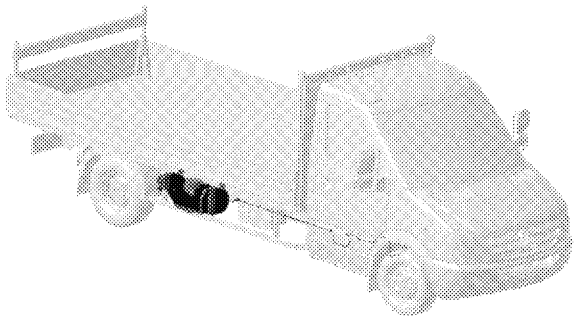
Cargo/Passenger Van types with 6 cylinder diesel engine:

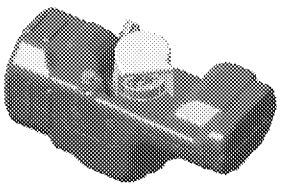




SCR-tank volume	4.1 gal.(19,2 L)
SCR-range	7500 mi
Diesel/SCR-ratio	15/1

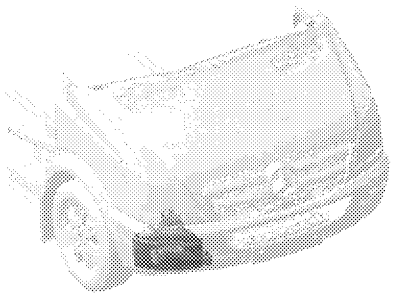
Cab chassis types with 6 cylinder diesel engine:

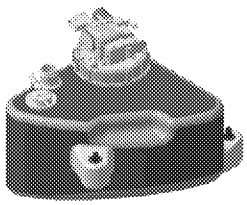




SCR-tank volume	4.9 gal.(22,2 L)
SCR-range	9000 mi
Diesel/SCR-ratio	18/1

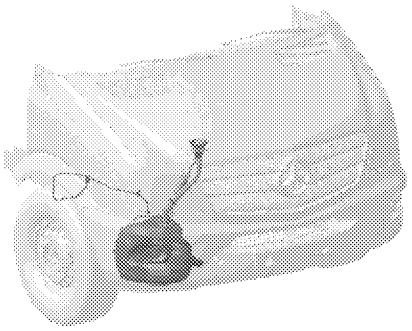
Podest type for custom applications (vocational, RV, etc.) with 6 cylinder diesel engine.
Ex: Frameside SCR-Tank installation interfers with RV-entrance

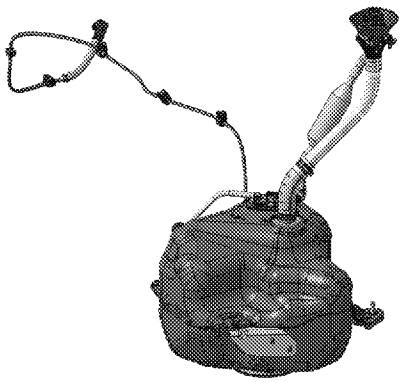




SCR-tank volume	4.1 gal.(12 L)
SCR-range	4800 mi
Diesel/SCR-ratio	10/1

All model-types with 4 cylinder diesel engine





SCR-tank volume	4.8 gal.(18 L)
SCR-range	5600 mi
Diesel/SCR-ratio	11/1

Your review and approval is highly appreciated.

Sincerely

Markus Loesch