



Diesel Exhaust Fluid (DEF) Facts

With the 2010 Emissions Regulations and the use of SCR emissions control systems around the corner, you can depend on Cummins Filtration to provide you with the information you need about DEF.

Q. What is Selective Catalytic Reduction (SCR)?

A. SCR is a technology that uses a urea based diesel exhaust fluid (DEF) and a catalytic converter to significantly reduce oxides of nitrogen (NOx) emissions.

Q. Is now a good time to invest in SCR technology?

A. All major engine manufacturers, with the exception of Navistar, stated they will use Selective Catalytic Reduction (SCR) to meet 2010 engine emission regulations.

Q. How does an SCR system work?

A. The DEF is injected into the hot exhaust upstream of the catalyst where it vaporizes and decomposes to form ammonia and carbon dioxide. The ammonia (NH₃) is the desired product which in conjunction with the SCR catalyst, converts the NOx to harmless nitrogen (N₂) and water (H₂O).

Q. What are the advantages for the fleet in using SCR technology?

A. Cummins 2010 engines will deliver what customers need in these challenging economic times. Cummins 2010 heavy duty engines utilizing SCR will provide substantial fuel economy improvement, up to 5%. SCR catalyst technology allows much greater NOx conversion efficiency, thereby allowing the engine to be fully optimized, which contributes to this fuel economy improvement. Another benefit to the improved fuel consumption is less frequent Diesel Particulate Filter (DPF) cleanout, thereby further reducing costs.

Q. What experience does Cummins have with SCR systems?

A. SCR technology is not new to Cummins. In 2006, Cummins launched its midrange engine certified to the Euro 4 standard using SCR for commercial vehicle applications in Europe. Cummins has built and shipped over 45,000 SCR engines to date. Cummins Emission Solutions has built and shipped over 200,000 SCR systems.

Q. How does DEF work within an SCR system?

A. The SCR system is to reduce levels of NO_x (oxides of nitrogen emitted from engines) that are harmful to our health and the environment. SCR is the aftertreatment technology that treats exhaust gas downstream of the engine. Small quantities of DEF are injected into the exhaust upstream of a catalyst, then converts to ammonia in the exhaust stream and reacts with NO_x over the catalyst to form harmless nitrogen gas and water.

Q. What is Diesel Exhaust Fluid (DEF)?

A. DEF is the reactant necessary for the functionality of the SCR system. It is a carefully blended aqueous urea solution of 32.5% high synthetic urea and 67.5% deionized water.

Q. What is urea?

A. Urea is a compound of nitrogen that turns to ammonia when heated. It is used in a variety of industries, including as a fertilizer in agriculture.

Q. Is DEF a toxic solution?

A. DEF is a nontoxic, nonpolluting and nonflammable solution. It is stable, colorless, odorless, and meets accepted international standards for purity and composition. MSDS sheets are currently available.

Q. How will I know that the DEF product I purchase will work?

A. The DEF you purchase should state and display the certification of the German Institute of Standardization DIN70700, the International Organization for Standardization ISO 22241-1, and meet AUS – 32 specifications. This will ensure the proper concentration (32.5%) of urea.

Q. Is the 32.5% urea solution critical?

A. Yes, The 32.5% urea concentration is the ideal solution as it provides the lowest freeze point. Also, SCR systems will be calibrated to the 32.5%, so that optimum NO_x will be reduced during operation.

Q. What is the freeze point of DEF?

A. A 32.5% solution of DEF will begin to crystallize and freeze at 11 deg F or -11 deg C. At 32.5%, both the urea and water will freeze at the same rate, ensuring that the fluid does not become diluted or over concentrated.

Q. With a freezing temperature of 11 deg F or -11 deg C, what happens to the operation of the vehicle if the DEF freezes?

A. If the DEF freezes, it will not inhibit the operator from starting the vehicle. DEF thaws quickly once you start the vehicle.

Q. Does anything happen to DEF solution once it freezes?

A. If the DEF freezes and is thawed, it does not change its efficiency.

Q. Will there be special equipment to ensure the DEF does not freeze, or can be thawed if it does freeze?

A. The installation of an SCR system will provide for the heating of the DEF tank and supply lines.

Q. Are there special storage requirements for DEF?

A. ISO 22241-3 specification details the storage, handling, and shelf life minimum expectations throughout the distribution chain. Storage between 86 deg F (30 deg C) and 40 deg F (4 deg C) is recommended.

Q. Is DEF corrosive?

A. DEF is corrosive to aluminum and other materials. Tank, packaging and dispensing equipment suppliers take all this into account and only use approved materials for their products.

Q. If DEF is corrosive to aluminum, what will the DEF tanks be made of?

A. DEF tanks (on vehicle) will be made from a non-corroding, highly durable composite material. Tank, packaging and dispensing equipment suppliers take all this into account and only use approved materials for their products.

Q. What package sizes will be available? When?

A. Cummins Filtration has offered DEF since 2003 in 4 sizes: 55 gal drum, 275 gal disposable tote, 330 gal tote, and bulk. Cummins Filtration plans to add small size containers to their existing DEF line in 2009. 2.5 gal and 5 gal containers will be added in Q2, 2009.

Q. What does IBC stand for?

A. Intermediate Bulk Containers (IBC) are all containers larger than a 55 gallon (207L) drum, and smaller than a tanker.

Q. Where will DEF be available?

A. In North America, all major truck stops have committed to carrying and selling DEF by end of Q2, 2009. The initial supply of DEF will most likely be in package containers versus bulk. In addition, Cummins Filtration is making DEF available to thousands of distributors, dealers, other outlets.

Q. What is the shelf life of DEF?

A. Shelf life of DEF is a function of ambient storage temperature. Expectations for shelf life as defined by ISO Spec 22241-3, are the minimum expectations for shelf life when stored at constant temperatures. DEF will degrade in time depending on temperature and exposure to sun light. Stated shelf life is based on continuous exposure to heat and sunlight and continuous exposure is unlikely. If stored between 10 and 90 deg F, shelf life will easily be one year. If the maximum temperature does not exceed approximately 75 deg F for an extended period of time, the shelf life will be two years.

Q. How much DEF will a truck consume?

A. DEF consumption is expected to be approximately 2% of fuel consumption, depending on vehicle operation, duty cycle, geography, load ratings, etc.

Q. What is the number of miles a truck can expect to travel on one gallon of DEF?

A. DEF consumption is directly related to fuel consumption, but a truck averaging 6 MPG can expect to go approximately 300 miles on one gallon of DEF.

Q. How can an operator determine how much DEF they will need/use?

A. It is expected that DEF consumption will be approximately 2% of the diesel fuel consumed. Another way to consider it is that DEF will be consumed on a 50 to 1 ratio with diesel. (For every 50 gallons of diesel fuel burned, you will use 1 gallon of DEF). If you know the average fuel consumption of a vehicle, you can calculate the amount of DEF that will be used:

Example...Medium Duty

Annual miles for average truck = 50,000 miles

MPG for average truck = 10 mpg

50,000 miles / 10 mpg = 5,000 gallons diesel fuel per year

DEF usage @ 2% of fuel consumption = 100 gallons of DEF / year

100 gallons / 10 gallon tank (average size) = 10 DEF fill-ups / year

Example...Heavy duty

Annual miles for average truck = 120,000 miles

MPG for average truck = 6 mpg

120,000 miles / 6 mpg = 20,000 gallons diesel fuel per year

DEF usage @ 2% of fuel consumption = 400 gallons of DEF / year

400 gallons / 20 gallon tank (average size) = 20 DEF fill-ups / year

Q. On SCR equipped vehicles, what changes will be expected for service intervals? (lube)

A. There will be no changes to the service intervals on SCR equipped vehicles. The SCR process impacts the exhaust emissions after they are produced by the engine, therefore will have no effect on the engine lube service intervals.

Q. Can an anti-gelling or freeze point improver be added to the DEF to prevent it from freezing?

A. No. The 32.5% solution is very specific to providing the optimum NOx reducing properties. Any further blending or adjusting of the DEF mixture will impede its ability to perform correctly and may cause damage to the SCR components. Additives of any type are not approved for use in DEF.



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