THE HEAVY EQUIPMENT OPERATOR'S GUIDE TO

HANDLING DEF OFF-ROAD

When it comes to using DEF in off-road environments, many equipment operators are unaware of how to handle DEF and what's at stake when it isn't done properly. In this guide, we cover the best practices so you can PROTECT YOUR HIGH HORSEPOWER EQUIPMENT.

THUNDER CREEK EQUIPMENT

HOW OFF-ROAD DIFFERS FROM ON-HIGHWAY

For on-highway industries, the machine goes to the DEF. For off-highway industries, DEF must go to the machine. This distinction is significant.

DEF is easily contaminated and off-road environments are, quite frankly, dirty. It's not often that a truck stop is considered clean, but when you compare it to a construction site, a farm field or a quarry, it is. It's also easier to control the climate around a fixed source of DEF than a mobile one. We'll discuss both these challenges in greater detail as we go through this guide.

WHAT CAN CONTAMINATE DEF?

Dirt, dust, fuel, oil, and debris. The earth metals found in tap water. The copper-, chromium-, zinc- or nickel-plated metal found in fittings, couplers and other fluid handling equipment. These are common sources of DEF contamination.

For off-road equipment operators, the greatest risk occurs when transferring DEF to the machine. If you handle DEF the same way you handle fuel and other fluids, you are likely to introduce contamination.

The ISO 22241 Standard identifies proper practices for making and handling DEF. When we manufacture our systems, we only use materials approved in the standard. Our DEF hoses, for example, are manufactured in an isolated area to ensure there is no cross-contamination from other areas of the facility. We sterilize and seal each system in accordance with the standard. Others who make reusable DEF systems do not adhere to the standard this strictly.

HOW CONTAMINATED DEF AFFECTS MACHINERY

Contaminants affect the catalyst in the SCR system. The inside of a catalyst is structured like a honeycomb. Over time, contaminants get trapped here. Some will cause corrosion as they react with DEF, which is 32.5% urea. Others will form gummy deposits that will eventually plug the catalyst.

Damage to the catalyst is not immediate, but once contaminants have been introduced, damage is irreversible. You can't repair a catalyst, it can only be replaced. SCR systems use rare-metals catalysts. These are expensive and are usually not covered by warranty.

Contaminants can also affect the injection system of an SCR system, plugging it as the fluid is injected into the exhaust system.

A system using contaminated DEF becomes less effective at removing emissions, so it will begin to consume more fluid. Eventually, the damage will cause the SCR system to shut down. Depending on the machine, this may either initiate a fault code or shut the machine down entirely.

Damage doesn't occur immediately upon using contaminated DEF. Once signs of contamination are present, it's usually too late.

DEF is contaminated by direct or airborne contact with many common elements. As little as a tenth of a teaspoon of many contaminants is enough to bring a 5,000 gallon tank of DEF off-spec.

MYTH

Filtration systems remove contaminants from DEF.

This is a common misconception. Though many machines are equipped with DEF filtration systems, they are designed to catch particulate that may be present in the fluid. They are not capable of eliminating contaminants.

HOW TO PREVENT CONTAMINATION

Purity is irrelevant without proper handling practices. You want to handle DEF like you want a hospital to handle your surgical equipment. If the scalpel is manufactured in a sterile environment but the janitor punctured the package when he put it in the supply closet, it's no longer clean.

Every Thunder Creek DEF Solution is equipped with our exclusive 2-in-1 DEF Pumping System. This is a closed system that fills and dispense DEF without exposing it to contamination. It's the key that makes our solutions ISO compliant for life.

HOW TEMPERATURE AFFECTS DEF

Prolonged exposure to direct sunlight and higher temperatures will cause DEF to degrade faster. The graph (lower right) shows the shelf life as it relates to the temperature of the area where DEF is stored.

DEF freezes at 12°F. Freezing and thawing do not affect the chemical properties of DEF, but the fluid needs to be fully thawed before use. Also, DEF expands by approximately 7% when frozen. This can cause damage to pumping components and fully-filled, closed containers.

Temperature and humidity may also impact DEF consumption. When the engine intake air is warmer and more humid, more NOx is created through the combustion process, therefore more DEF is required to remove it.

HOW TO MANAGE TEMPERATURE OFF-ROAD

Here are the best practices for managing the effects of temperature in off-road environments.

- Protect DEF from exposure to direct sunlight.
- Protect DEF from extreme temperatures.
- Protect handling systems from expansion when DEF freezes.
- Never use additives to prevent freezing. They can cause contamination.

Thunder Creek DEF Solutions are enclosed to protect the fluid from direct sunlight as well as to serve as a barrier to temperature extremes. Our pumping systems are able to back flush fluid into the tanks, which are designed to flex with expansion. This prevents damage should DEF freeze. There are options for additional insulation and heaters as well.

BEST PRACTICES

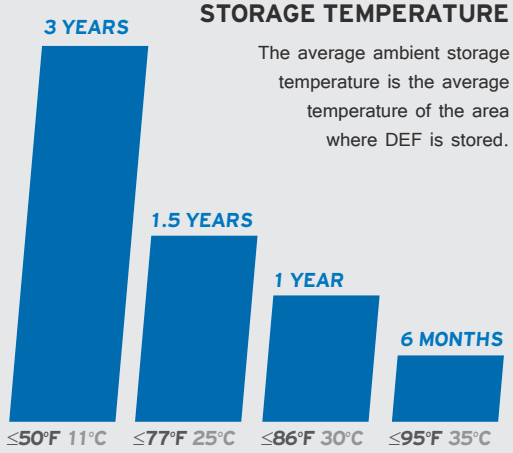
MAINTAINING DEF PURITY OFF-ROAD

1. **Purchase API Certified DEF from a reputable source.**
2. **Only use closed or sealed systems. A sealed system is a single use container, like a jug or a drum. A closed system is a reusable and can be filled through a closed coupler.**
3. **Never reuse or refill containers that have been opened.**
4. **Never use dispensing equipment like funnels, transfer containers, pumps, seals, fittings, hoses, etc. that are have not been made in accordance with the ISO 22241 Standard.**
5. **Remove dirt and debris around the DEF fill port on machinery.**

SHELF LIFE

BY AVERAGE AMBIENT STORAGE TEMPERATURE

The average ambient storage temperature is the average temperature of the area where DEF is stored.



THUNDER CREEK DEF SOLUTIONS

MAINTAIN DEF PURITY TO PROTECT TIER 4 MACHINERY

+ CLOSED SYSTEMS
+ ISO COMPLIANT FOR LIFE
+ TOTES, TRAILERS AND BULK SOLUTIONS

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