Brought to you by:

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Diesel Particulate Filters

Definition

Diesel particulate filters (DPF) are devices that physically capture diesel particulates to prevent their release into the atmosphere.

Diesel particulate filter materials have been developed that show impressive filtration efficiency, in excess of 90%, as well as good mechanical and thermal durability. Diesel particulate filters have become the most effective technology for the control of diesel particulate emissions—including particle mass and numbers—with high efficiency.

Due to the particle deposition mechanisms in these devices, filters are most effective in controlling the solid fraction of diesel particulates, including elemental carbon (soot) and the related black smoke emission. Filters may have limited effectiveness, or be totally ineffective, in controlling non-solid fractions of PM emissions. To control total PM emissions, DPF systems are likely to incorporate additional functional components targeting gas emissions, typically oxidation catalysts, while ultra-low sulphur fuels may be required to control sulphate particulates.

The term “diesel particulate trap” is sometimes used as a synonym for “diesel particulate filter”, especially in older literature. The term “trap” covers a wider class of particle separation devices. Several particle deposition mechanisms other than filtration are commonly employed in industrial dust separation equipment. Examples include gravity settling, centrifugal separation, or electrostatic trapping. None of these techniques could be adopted to control diesel PM emissions, due to the small particle size and low density of diesel soot.

Collection & Regeneration

Due to the low bulk density of diesel particulates, which is typically below 0.1 g/cm3 (the density depends on the degree of compactness; as an example, a number of 0.056 g/cm3 was reported by Wade [Wade 1981]), diesel particulate filters can quickly accumulate considerable volumes of soot. Several litres of soot per day may be collected from an older generation heavy-duty truck or bus engine. The collected particulates would eventually cause excessively high exhaust gas pressure drop in the filter, which would negatively affect the engine operation. Therefore, diesel particulate filter systems have to provide a way of removing particulates from the filter to restore its soot collection capacity. This removal of particulates, known as the filter regeneration, can be performed either continuously, during regular operation of the filter, or periodically, after a pre-determined quantity of soot has been accumulated, in either case, the regeneration, which cleans the blocked-up filter should be "invisible" to the vehicle driver/operator and should be performed without his intervention.

Sintered Metal Filter System (SMF)

SMF's trap the soot at the exhaust outlet resulting in zero black smoke being emitted into the environment that the forklift operates in.

These filters saturated with soot will ignite at +-400 degrees celsius automatically, forming ash that will be collected in the filterhousing. This ash, under normal conditions, needs only be removed every 1200 operating hours, or with each service interval by releasing two clamps. The cleaning process comprises of spraying the filter with a high pressure water hose, and then allowing the filter to dry before inserting it back inside the filter housing.

2.5ton TCM Forklift with SMF-AR System

Sintered Metal Filter with Automatic Regeneration (SMF-AR)

The SMF-AR system accommodates the engine type that does not reach the required exhaust temperatures when regeneration is necessary. This process is accomplished by adding an additive, and heating coils to the filter that will reduce the flash-point and increase the regeneration cycles.

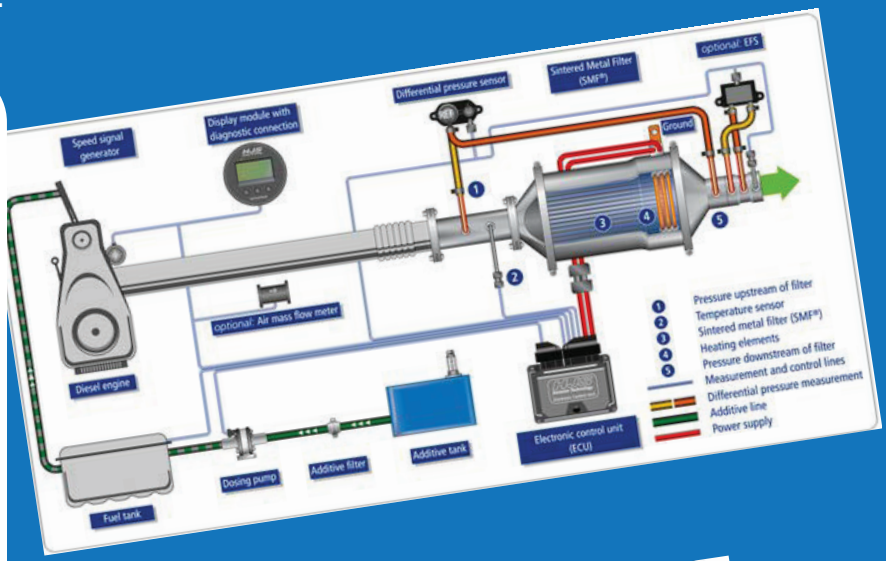
The additive was originally manufactured to improve the engine and injector lifetime, and later proved to lower the flash point of the soot. 1L of additive should, as a rule, last up to 2000L of diesel fuel. The display unit of the SMF-AR system will indicate both the diesel and additive tank levels.

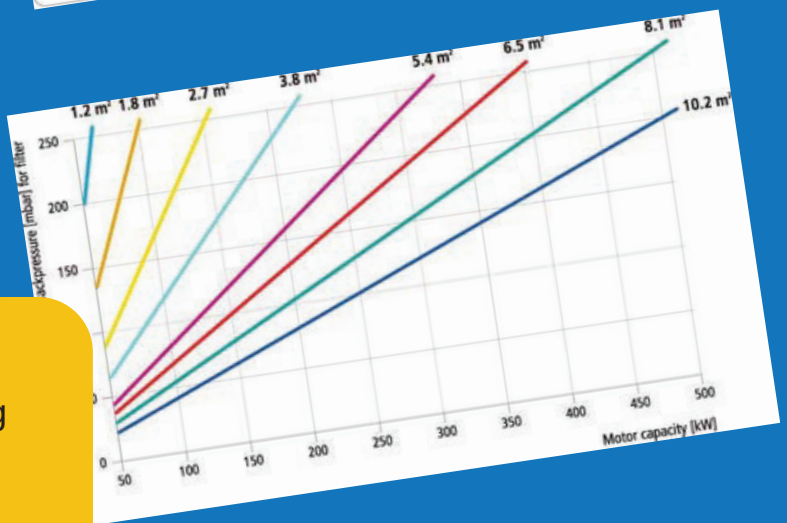
Note: an electric level sensor should be available on the diesel tank.

This system will regenerate the filter before the back pressure reaches OEM maximum allowable levels. These maximum OE back pressure and owner safeguard levels are programmed into the system at installation stage as a safeguard.

The SMF-AR System consists of:

1. A sintered metal filter inside a stainless steel housing,
2. Engine control unit (ECU) to control the regenerating process, run diagnostics, log backpressure levels, over revving (abuse), exhaust temperatures and fuel and additive tank levels,
3. Display unit,
4. Warning buzzer,
5. Additive tank,
6. Mass Airflow Sensor (MAF),
7. Back pressure and temperature probes





Filter Sizing:
The filter size in m², is determined by using these factors together with the available space for fitment and ease of access for servicing of the unit. The diagram provides a quick reference of the filter size to be fitted.