



BISAF Ltd.

THE "PARTICULATOR™"

Shown to virtually eliminate
Diesel Particulate Matter from exhaust fumes

AN OVERVIEW

PURPOSE

- 99%+ reduction of exhaust gas Soot Particles when fitted to small Diesel Engines (less than 30kW / 40hp e.g. Micro / Mini Diggers, Generators, Mechanical Access Equipment e.g. Cherry Pickers, Scissor Lifts).
- The same exhaust gas filtration technology as used on the latest Stage V machines.
- Indispensable when operating diesel engines in confined spaces, e.g. tunnels, railway stations, basement conversions, shopping malls etc.

VERSATILITY

- BISAF Diesel Particulate Filters can be fitted to almost any type of equipment that is powered by a small diesel engine.
- The Filters can be mounted / removed in less than five minutes
- A pressure gauge indicates when the DPF needs to be regenerated
- Regeneration is simple and usually takes place in around half an hour by connecting a power supply to the Particulator while its mounted to the machine.
- There are no consumables (e.g. replacement filters) required

MAINTENANCE

- Apart from regeneration and annual service, no maintenance is needed
- The particulator uses automotive quality component parts with stainless steel fabrications making it durable and effective. It has been designed for component parts to be replaced easily in case of damage.
- DPF's carry a 6 months warranty

CERTIFICATION

- BISAF DPF's are made from VERT approved components
- BISAF DPF's was tested at CAMBUSTION LTD (Automotive Test Laboratory) in May 2018 and a test report is available (see Appendix)



DESCRIPTION OF THE SYSTEM

The Particulator is designed to be easily fitted to and removed from smaller construction machines.

It removes the Diesel Particulate Matter from the exhaust gas before it can come into contact with the machine operator and others in the working area. Diesel Particulate is considered the component of Diesel exhaust that is most dangerous to human health as it can cause lung cancer and other heart and lung problems.



The Particulator consists of a particulate filter that is encased in an insulated stainless steel jacket with inlet and outlet cones connected to the central filter unit with V clamps.

The exhaust from the machine is fed into the Particulator by a flexible metal pipe that is attached to the exhaust outlet from the machine's silencer and the inlet pipe at the bottom of the filter assembly.

The other main component of the Particulator is the control cabinet that contains the electronics to control the regeneration of the filter, a push button to start regeneration and the back pressure monitor.

When regeneration of the filter is required, an external power supply is connected to the control cabinet.

The Particulator is mounted to the machine using a frame. An (optional) perforated metal heat shield gives protection from the high temperatures on the surface of the filter, particularly during regeneration.



HOW IT WORKS

The exhaust gas is fed from the machine exhaust outlet into the Particulator where it passes through a physical filter.

The filter is made of cordierite, a synthetic ceramic developed for flow-through catalyst substrates and subsequently adapted for the filter application.

Cordierite filters are distinguished, among other diesel filter designs, by high surface area per unit volume and by high filtration efficiencies. This gives high filtration efficiency while keeping back pressure low.

They contain many - typically square - channels that run axially the length of the filter. Channels are alternately capped off, forcing the exhaust gas through the microscopic pores of the walls.

Cordierite is extremely heat resistant and regeneration can be effected by burning off the fine diesel particles that get trapped in the channels.

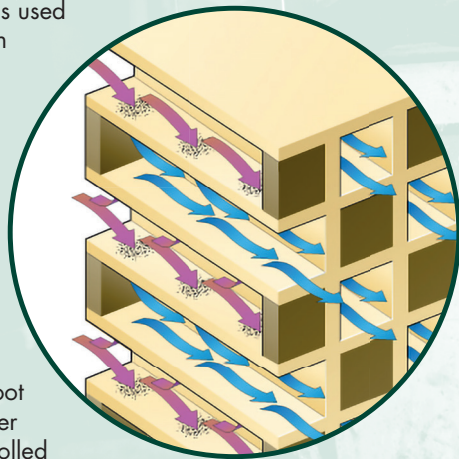
This is the same filtration technology that is used in new cars, trucks and larger construction machines to meet the toughest global emissions standards.

During machine use, the filtered Diesel particulate is held in the filter and this leads to a gradual increase in back pressure.

To prevent the exhaust back pressure reaching levels that would affect the machine performance or ultimately risk damaging the engine, the accumulated soot must be periodically removed from the filter by a regeneration process. This is a controlled heating cycle that burns the soot from the filter.

The Particulator is fitted with a device that monitors back pressure and indicates to the machine operator when regeneration is required. It is recommended that regeneration is carried out daily when the machine is in use.

A small part of the particulate trapped in the filter is not removed during the regeneration process as it is composed of non-combustible material that originates from oil that is burnt in the engine. This will be removed during an annual service carried out by BISAF.



BEFORE AND DURING OPERATION

FITTING THE PARTICULATOR TO THE MACHINE

A supporting frame is designed for each type of machine.

Once the frame is in place, the Particulator is easily fitted to the frame with the bolts provided.

The Particulator weighs approx. 40kg and fitting the Particulator to the frame is a two person operation.



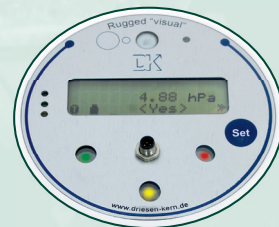
Once the Particulator has been securely fitted to the supporting frame, a flexible exhaust pipe is used to connect the machine's exhaust outlet with the "Particulator's" exhaust inlet.

DURING MACHINE OPERATION

The Particulator does not require any inputs during machine operation but the back pressure gauge should be monitored at regular intervals during operation to check that the back pressure is within the normal range.

BACK-PRESSURE INDICATOR CLEARLY INDICATES:

- regeneration not yet due (**green**)
- regeneration is due (**yellow**)
- regeneration is overdue (**red**)



IMPORTANT SAFETY INFORMATION:

- Operate in well ventilated space.
- Do not touch the filter unit during operation or for at least one hour afterwards.
- Do not connect the electrical supply for regeneration if the particulator is wet.



**Keep well
Ventilated**



CAUTION HOT
Do not touch



**ELECTRICAL
HAZARD**



REGENERATING THE PARTICULATOR

If the back pressure reaches a level requiring regeneration, or at least once in a working shift, a regeneration must be made in order to remove accumulated particulate and reduce back pressure to an acceptable level.

To start regeneration, turn off the machine's engine, connect the required electrical supply (depending on the model, the "Particulator" requires 110VAC, 230VAC or 24VDC input - this will be clearly marked on the control cabinet) and press the button marked "Clean Filter" that will start the regeneration process.

GREEN LIGHT:

Indicates phase of regeneration.

RED LIGHT:

Indicates that power is connected. Regeneration ends automatically at the end of the cycle. Regeneration can be stopped at any time by pressing the red button.



When power is connected, the red button lights up. Pressing the "Clean Filter" button starts the regeneration process and a green light around this button flashes slowly. After approximately 15 minutes, the green button light will flash more quickly as the next phase of the regeneration starts.

During regeneration, there is normally some visible smoke from the outlet of the Particulator as combustion of the trapped particulate takes place.

When the green light stops flashing and the red button lights up, the regeneration has been completed. The power can be disconnected and the machine used again.

If there is a need to stop the process during regeneration, press the red button.



WHAT THE EXPERTS SAY

BISAF's "Particulator™" was rigorously evaluated by CAMBUSTION LTD Ltd. – the independent automotive test laboratory in Cambridge in May 2018.

TEST SETUP:

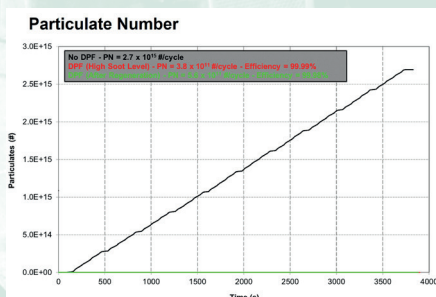
- The vehicle used was a Bobcat excavator
- Fuel used (red diesel as received)
- Primary measurements were emissions in a dilution tunnel.
- Gaseous Emissions (THC, CO, NO_x, CO₂)
- Particulate Emissions – Number (PN, using PMP technique), Mass (PM via DMS500) & Size (via DMS500).

Other measurements were taken:

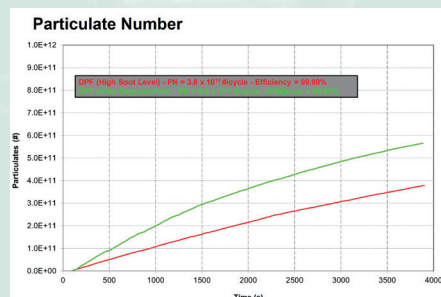
- DPF Internal Temperatures, nine internal filter thermocouples
- DPF Inlet Temperature (between the heater element and the front face of the DPF)
- 'DPF Wall' Temperature (between the filter cartridge and the wall of the filter assembly)



PARTICULATE NUMBER EVALUATION



Graph 1: PN count (No DPF v loaded DPF v regenerated DPF)



Graph 2: PN count - magnified (Loaded v regenerated DPF)

Cambustion Key Conclusions:

- The DPF system fitted to the Bobcat excavator in this case was very effective at removing particles from the exhaust stream:
- Well over 99.9% efficiency of particle removal.
- The regeneration of the filter appeared to be effective:
- DPF backpressure was substantially lower after the regeneration.
- Temperatures within the DPF during the regeneration cycle were sufficiently high to oxidise soot on the DPF.





BISAF Ltd.

**GIANT ARCHES 12-23, 48A BURBAGE ROAD
HERNE HILL, LONDON, SE24 9HE**

**020 7326 5714
ENQUIRIES@BISAF.CO.UK
WWW.BISAF.CO.UK**

BISAF Ltd. is part of the PREMIER GROUP OF COMPANIES which also comprises
Premier Plant Hire and Premier Plant Haulage.

Our organisation is dedicated to providing innovative solutions
to construction and related industries.

For more information see also:

www.premierplanthire.co.uk
www.premierplanthaulage.co.uk

