



Introduction

When a DPF is completely clean (for instance following regeneration), the penetration of soot through the DPF is significantly higher than when it is slightly loaded. It can be important to characterise the increase in soot filtration efficiency with sootload for a given part. If a part becomes damaged, the filtration of soot may also be impaired and it can be useful to define a 'pass/fail' criterion which can be based on soot filtration efficiency at a given soot load. This application note discusses these.

The Efficiency % may be defined as:

$$\eta = 100 \times (1 - \text{Outlet} / \text{Inlet})$$

(where *Inlet* is aerosol measurement at DPF inlet and *Outlet* is aerosol measurement at DPF outlet)

Penetration% is 100- efficiency %

A suitable aerosol measurement instrument (eg AVL415S) measuring up and downstream of a DPF can be used in conjunction with the loading test (described in dpg001v02) to determine the change in trapping efficiency of a part as it becomes loaded.

The stability of the soot generation rate from the burner means that a single instrument may be used to monitor the downstream soot – occasionally checking the upstream soot rate.

Typical characteristics for efficiency in terms of soot mass and particle number are shown in

Figure 1. For Light duty DPFs (between 3 and 4 litre volume), the efficiency is >99% for 0.5g total soot load. For this reason, it may be convenient to reduce the soot loading rate at the start of load (eg from the standard setpoint of ~10g/hr to ~2 g/hr).

The 'high transmission' phase of the load is associated with the 'pore filling' load phase (see application note DPG 001 for details)

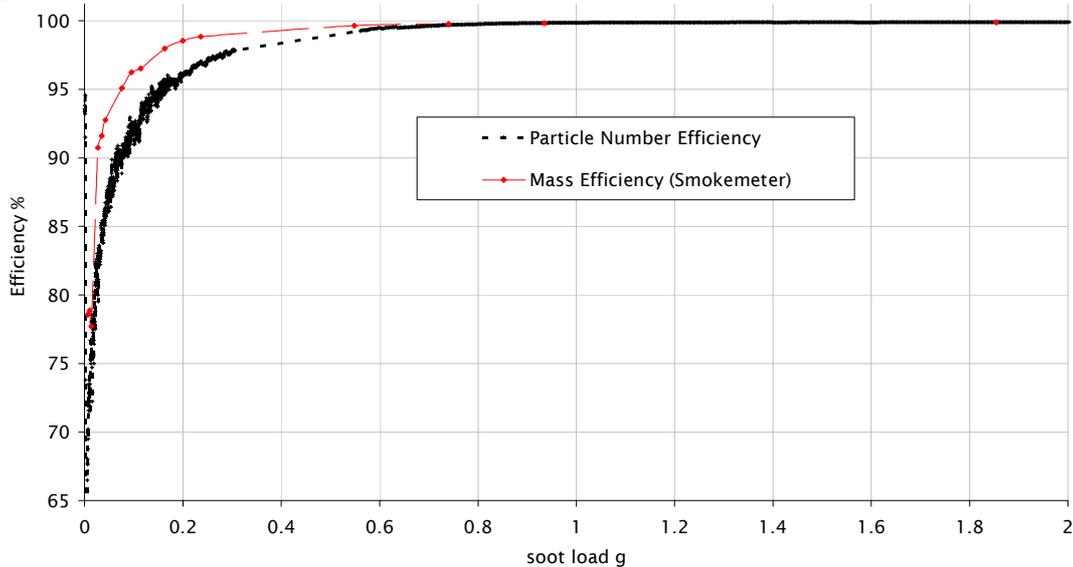


Figure 1 Efficiency of (undamaged) DPF vs sootload measured with AVL415 (mass) and CPC TSI 3022 (number)

Figure 2 shows the 'penetration' for two different filters from clean during identical 'efficiency' tests using the AVL415.

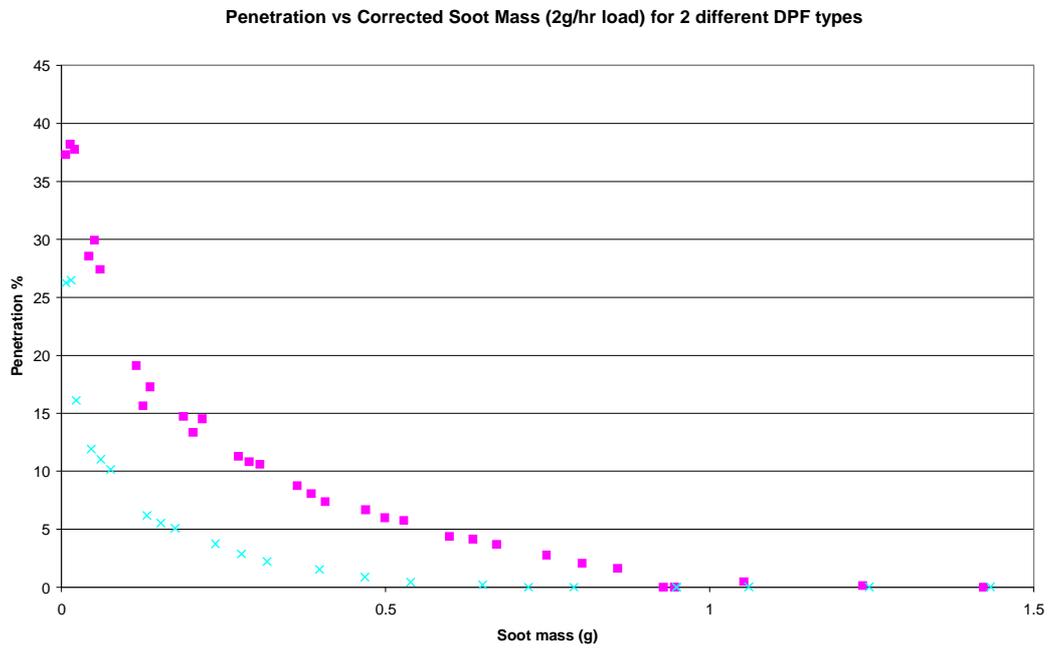
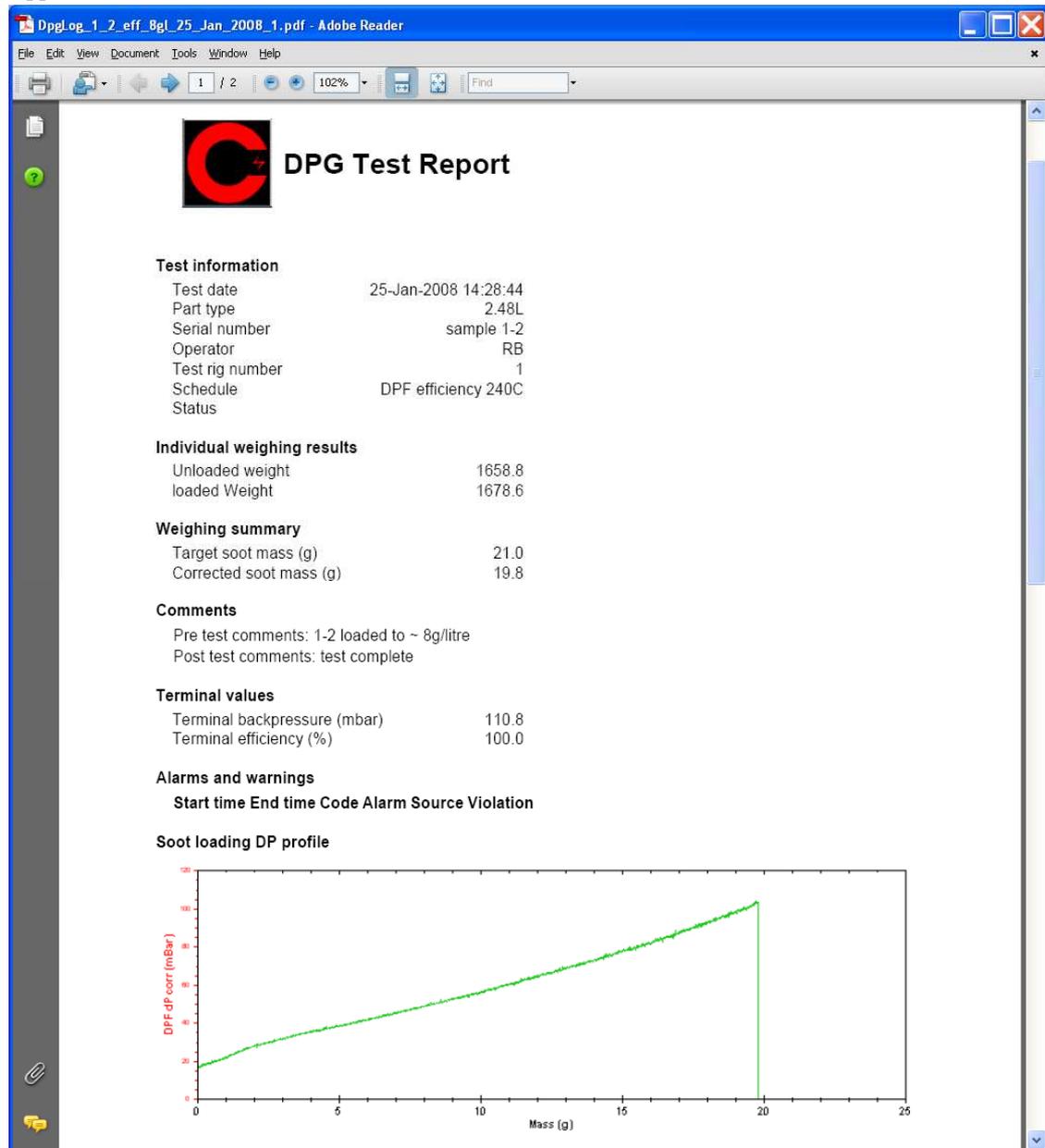


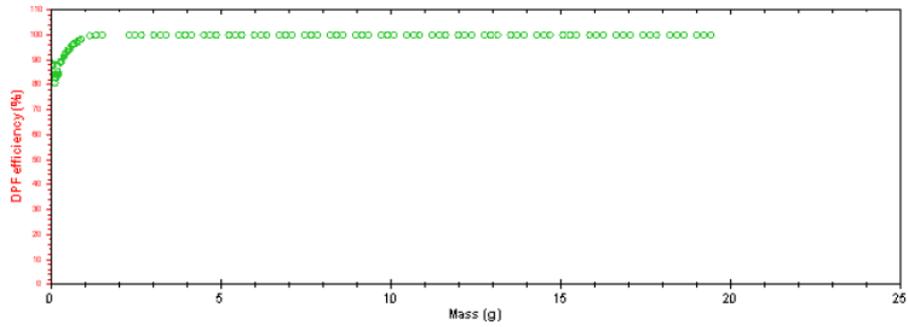
Figure 2 Comparative loads for two different substrates

The Appendix shows a standard report from an efficiency measurement soot load, together with penetration vs soot load calculated from the datafile.

Appendix



Soot loading efficiency profile



Modes used

Mode name	Duration (s)	Soot mass rate (kg/s)	1 air flow (kg/hr)	2 air flow (kg/hr)	1 air temp (C)	2 air temp (C)	Exhaust BV	Fuel flow (kg/hr)	DPF flow (kg/hr)	DPF temp (C)
Stabilise	60	0	17.8	155.04	50	50	false	0	250	50
warmup	600	0	17.8	155.04	50	50	false	1.065	250	240
base fuel										
Weigh	0	0	0	0	0	0	false	0	0	0
warmup	300	0	17.8	155.04	50	50	false	1.065	250	240
base fuel										
2g per hour load	1800	2	11.7	155.04	50	50	false	1.064	250	240
10g per hour load	7200	10	9.93	155.04	50	50	false	1.065	250	240
warmup	0	0	17.8	155.04	50	50	false	1.065	250	240
base fuel										
Weigh	0	0	0	0	0	0	false	0	0	0
Standby	0	0	0	0	0	0	false	0	0	0