NoTox® Silicon Carbide Diesel Particulate Wall Flow Filter

Technical Product Information

Features:
- No melting problems
- High soot load tolerant
- High permeability
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Unless otherwise stated all dimensions and measurements after ISO standards. Numbers are given in EU/ISO notation where the comma denotes the decimal place and the period thousands, etc..
Introduction

Constant improvements in the product lead to optimization of the specifications and broader understanding of implementation.

This fourth edition replaces all previous editions.

Please note the separate Canning Specification, available on special request and under a secrecy agreement, containing 28 pages of technical information and experience.

NoTox® Silicon Carbide Diesel Particulate Wall Flow Filter

Technical Product Information

Features:
- No melting problems
- High soot load tolerant
- High permeability

The goal

Reducing particulate emissions from diesel engines is preferably done by separating the soot from the hot exhaust gas with high temperature stable barrier filters.

The Wall Flow Filter, WFF, is preferably constructed from an extruded square shaped cell honeycomb structure in which every second channel is closed at alternate ends in a chess board like pattern in order to force the gas through the porous wall. With the NoTox WFF, the filtration efficiency of a diesel engine’s Total Particulate Matter, TPM, can easily be >85% initially with 25 µm pore and >90% after just 10 minutes of operation without losing important permeability.

Either continuously or at appropriate intervals, the accumulated soot particles are oxidized and the filter is cleaned.

The basic material, Silicon Carbide, features exceptional thermal stability so that the diesel WFF is guarantied against any melting problems. Possible cracks caused by thermal stress are prevented by manufacturing techniques and filter design.
NoTox Corporation offers a wide variety of ceramic diesel Wall Flow Filter substrates divided into specific groups, which can easily be matched to the specific needs of each emission control application.

**Basic substrates**
The following standard substrate set volumes are currently available:
- NoTox L2
- NoTox L3
- NoTox L6
- NoTox L8
- NoTox L10
- NoTox L13
- NoTox L20
- NoTox L23

**Semi-Finished**
Semi-Finished modules available as base substrate set canned on the outside circumference with one or two layers 6,5 mm Interam XD 4200 gram/m² into AISI 304 1,5 mm wall thickness pipe app. 30 mm longer than the substrate:
- NoTox L2-SF
- NoTox L3-SF
- NoTox L6-SF
- NoTox L8-SF
- NoTox L10-SF
- NoTox L13-SF
- NoTox L20-SF
- NoTox L23-SF
Substrate product code
NoTox L2-Ø118×L154-F820

Substrate Dimension
Ø 118 × L 154 mm
Ø 4.66 × L 6 inch

When ordered as a Semi-Finished module, add SF to the product code, such as:
NoTox L2-Ø118×L154-F820-SF

Semi-Finished dimension
Ø 132 × L 170 mm

Option
- Pore size
- Substrate alternatively 125 mm long, 1.4 litre
- One piece unit only
- Semi- or Fully-Finished
NoTox 2,6 litre WFF base substrate

Substrate product code
NoTox L3-Ø144×L154-F820

Substrate Dimension
Ø 144 × L 154 mm
Ø 5.66 × L 6 inch

When ordered as a Semi-Finished module, add SF to the product code, such as:
NoTox L3-Ø144×L154-F820-SF

Semi-Finished dimension
Ø 158 × L 170 mm

Option
• Pore size
• Four segments or one piece unit
• Semi- or Fully-Finished
NoTox 6 litre WFF base substrate

Substrate product code
NoTox L6-Ø190×L205-F820-4

Substrate Dimension
Ø 190 × L 205 mm
Ø 7.5 × L 8 inch

When ordered as a Semi-Finished module, add SF to the product code, such as:
NoTox L6-Ø190×L205-F820-4-SF

Semi-Finished dimension
Ø 222 × L 235 mm

Option
- Four segments only
- Pore size
- Semi- or Fully-Finished
- L8 four segments, two phase EI-Heated module length 255 mm
NoTox 8 litre WFF base substrate

Substrate product code
NoTox L8-Ø228×L205-F820-7

Substrate Dimension
Ø 228 × L 205
Ø 9 × L 8 inch

When ordered as a Semi-Finished module, add SF to the product code, such as:
NoTox L8-Ø228×L205-F820-7-SF

Semi-Finished dimension
Ø 252 × L 235 mm

Option
- Pore size
- Semi- or Fully-Finished
- Four or seven segmented
- Seven segments, three phase EI-Heated module
NoTox 10 litre WFF base substrate

Substrate product code
NoTox L10-Ø228×L255-F820-7

Substrate Dimension
Ø 228 × L 255
Ø 9 × L 10 inch

When ordered as a Semi-Finished module, add SF to the product code, such as:
NoTox L10-Ø228×L255-F820-7-SF

Semi-Finished dimension
Ø 252 × L 285 mm

Option
- Pore size
- Semi- or Fully-Finished
- Four or seven segmented
- Seven segments, three phase El-Heated module

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**NoTox 10 litre WFF base substrate**

**Substrate product code**
NoTox L10-Ø250×L205-F820-7

**Substrate Dimension**
Ø 250 × L 205  
Ø 10 × L 8 inch

When ordered as a Semi-Finished module, add SF to the product code, such as:  
NoTox L10-Ø250×L205-F820-7-SF

**Semi-Finished dimension**
Ø 282 × L 235 mm

**Option**
- Pore size
- Semi- or Fully-Finished
- Seven segments, three phase El-Heated module
NoTox 13 litre WFF base substrate

Substrate product code
NoTox L13-Ø250×L255-F820-7

Substrate Dimension
Ø 250 × L 255
Ø 10 × L 10 inch

When ordered as a Semi-Finished module, add SF to the product code, such as:
NoTox L13-Ø250×L255-F820-7-SF

Semi-Finished dimension
Ø 282 × L 285 mm

Option
• Pore size
• Semi- or Fully-Finished
• Seven segments, three phase El-Heated module
NoTox 20 litre WFF base substrate

Substrate product code
NoTox L20-Ø286×L 305-F 820-7

Substrate Dimension
Ø 286 × L 305
Ø 11.25 × L 12 inch

When ordered as a Semi-Finished module, add SF to the product code, such as:
NoTox L20-Ø286×L 305-F 820-7-SF

Semi-Finished dimension
Ø 326 × L 350 mm

Option
• Pore size
• Semi- or Fully-Finished
• Seven segments only
NoTox 23 litre WFF base substrate

Substrate product code
NoTox L23-Ø286×L 355-F820-7

Substrate Dimension
Ø 286 × L 355
Ø 11.25 × L 14 inch

When ordered as a Semi-Finished module, add SF to the product code, such as:
NoTox L23-Ø286×L 355-F820-7-SF

Semi-Finished dimension
Ø 326 × L 390 mm

Option
• Pore size
• Semi- or Fully-Finished
• Seven segments only
Electrical heating is one of the many advantages of the NoTox Technology and is made possible by the exceptional thermal conductivity of SiC and the split-substrate design with internally placed heating elements. The supplied energy is used with maximum efficiency and heat loss to the surroundings is minimized. There are two basic system techniques which appear practical for electrical regeneration.

**Off-vehicle heating**

One technique uses external power supply from the mains, usually 110 or 230-400 volt AC and heats the filter substrate with commonly available pipe heating elements for regeneration during a period when the vehicle is parked. Everything is controlled by very simple and low cost arrangements.

This principle has been shown to work reasonably well with Cordierite WFF for city busses, Forklift Trucks and fleets of vehicles, all of which have a regular duty cycle and a regular period in which the vehicle is not driven. Heating time with the Cordierite material is from 2-6 hours in order to heat the substrate sufficiently to start the soot oxidation. The energy is rather inefficiently used, due to the poor thermal conductivity of the Cordierite ceramic filter substrate. Also, a substantial amount of the supplied heat is lost to the surroundings due to the external position of the heating element.

In the case of vehicles with regular duty cycles, such as Forklift Trucks, use of the NoTox technology combined with mains connection will result in a connection time of app. 30 minutes for a complete regeneration. This is comparable to the length of the lunch break for most drivers. Thus the NoTox SF Heated WFF technique represents a substantial saving in electricity consumption and, maybe more important, the ve-
Vehicles can be operated in a three shift cycle. For Forklift Trucks accepting 30 minutes regeneration time, the illustrated NoTox prototypes show the value of this technology. The following examples explain physical size and necessary heating element power. All are based on regeneration every four hours.

### Small diesel engines

**NoTox L6**
Natural aspirated 3 litre diesel engines require a 6 litre capacity NoTox L6 STS filter rated at 3600 Watt in 230 VAC. The complete system is only 250 mm in diameter with an overall length of 380 mm, giving high filtration capacity/ outside volume ratio. System weight is less than 20 kg as shown on photo.

### Larger diesel engines

Larger diesel engines require larger filter systems. Such may be based on Ø 250 mm substrate segments giving NoTox L13. Alternatively, two identical NoTox L6 or L8 STS units may be assembled over a central gas inlet section giving a slim-line system with two exhaust outlets, one in each side.

**NoTox L13**
NoTox L13 STS unit with 13 litre capacity and 6 kW/3-phase 230/400 VAC supply. This single module system is app. 320 mm in diameter and 400 mm long.

**NoTox 2×L6**
NoTox 2×L6-STS unit with 12 litre capacity and 7.2 kW/3-phase 400 VAC supply. This dual module slim-line design is only 250 mm in diameter and app. 800 mm long.

The only operation required by the driver is to
connect the power plug every four hours during a lunch break. An effective heating time around 20 minutes, six times a day in a three shift operation on a NoTox STS involves only 12 kWh/day energy consumption. Soot combustion air may be supplied either by an on-vehicle high voltage air pump, a 24 VDC on-vehicle air pump or, most cheaply, with shop compressed air. The operator can connect the electrical supply as well as the compressed air supply in the same connector.

Heating time

The graph illustrates the heating time for NoTox L6 STS high voltage filter system. When connecting this NoTox STS to the mains just after finishing driving, the trap temperature will be app. 100-150°C which reduces further heating in order to reach the actual soot ignition temperature (either 350, 400 or 600°C) to less than 20 minutes. The soot oxidation takes around 10 min. with a 20-100 litre/min. controlled combustion air supply.

The NoTox STS technology will show time and power savings when used with either:

- Fuel additive, regen. temp. at ~350°C or
- Noble metal catalyst coating, regen. temp. at ~400°C
- No help from any active material, regeneration temperature app. 600°C.

This STS (Soot Trap System) technology is fully developed and ready for production by interested system manufacturers.

On-vehicle heating

A variation of the electrically heated diesel filter system offers regeneration while driving and for an unlimited driving period. This PSTS (Passive Soot Trap System) technique takes advantage of:

- Power from only the vehicle’s own 24 volt DC system
- Very efficient use of the limited power due to the heating element placing
- Intelligent controls and strategy to make efficient use of exhaust heat to preheat one trap before regeneration
- Catalytically active fuel additive to form intimate contact with all soot particles and reduce oxidation temperature to as low as ~350°C, during the soot accumulation in the trap,
- Alternatively, catalytically PM coated trap for combustion temperature ~400°C further resulting in oxidation of CO and HC

Therefore, vehicles with too low a load for simple filter systems will benefit from an optimum PSTS installation including: two individual traps in the same container to be sequentially isolated from the main exhaust flow using a special designed exhaust gas diverter valve and a fuel additive for <400°C regeneration temp.
Material features

**Initial filtration efficiency** >98% with a 5 µm pore decreasing to >95% with 15 µm pore and >90% with 25 µm pore. We strongly recommend the 25 µm pore for outstanding flow behaviour.

**Filtration area** as high as 0.5 m²/litre filter which is the highest available ratio determined only by the honeycomb design and is similar to the known Cordierite WFF.

The **basic material** Silicon Carbide features exceptional thermal stability and easily exhibits a 10,000 hours use in oxidizing atmosphere at 1600°C. This is considerably higher than temperatures caused by exothermic reaction of even very large amounts of soot in the trap.

**Permeability** in NoTox WFF is two times higher compared to Cordierite WFF because:
- the number of pores per area is twice as high
- the NoTox powder technology completely eliminates commonly accepted blind pores.

**Thermal conductivity** is generally low for all ceramics but for SiC, as in the NoTox WFF, higher than 10 W/m-K, compared to Cordierite’s less than 0.5 W/m-K.

Relatively high **thermal expansion of SiC**, ~4×10⁻⁶ mm/°K as the origin of thermal stresses is controlled by manufacturing techniques and filter design in order to reach satisfactory safe soot limits.

High **corrosion resistance**, insured by the quartz surface on the porous structure, eliminates chemical reaction with accumulated ash from additives in the lubricating oil or diesel fuel. This allows 3-4 cleaning sessions of loose ash accumulation and by this the 250,000 miles lifetime.

**Material strength** for SiC is several times higher than for Cordierite, in the range of 25-40 MPa for the NoTox type of SiC compared to 2-5 MPa for Cordierite.

Silicon Carbide does not **melt** but the decomposing temperature >1800°C is considerably higher than any possible temperature peaks caused by any exothermic reaction of soot in the WFF.

The NoTox **channel closing** method is unique and a great improvement over traditional methods where 5-10 mm long plugs are pushed into every second channel. The NoTox method forms part of the substrate walls into a roof over the cell ends to close them, occupying no useful filtration surface area at the cell ends.

This reduces the need for a high canning pressure in order to prevent axial movement of the substrate. In multi-segmented substrate sets, telescoping of the centre segments is prevented with similar techniques.

The number of segments of the NoTox WFF influences the term »maximum safe soot load«. The higher the number of segments the higher the soot load before possible cracks may occur.

**Death-ring-area** in the front face circumference seen on some Cordierite WFF, generally used to help prevent axial movement, is not needed with the NoTox substrate technology.

**Monolith sizes** are identical to what the market by now accepts as being the standard for easy replacement.

NoTox substrate is manufactured with a technique that, in selected areas, increases the **friction** towards the insulating interface between substrate and canning metal container.
Max. safe soot limit test was performed on NoTox L6-F820 traps with four, five or nine segments connected to a MB OM616 4 cyl. 2,4 litre diesel engine loading the trap at 1300 rpm/65 Nm, increasing to 3500 rpm/110 Nm for five minutes for steady 750°C temperature in the complete trap followed by idling and no load sequence until complete regeneration.

Test fuel: Danish Shell Automotive Gas Oil, City Diesel with <50 ppm S, residual ash content 0.01%wt.
### Geometry information

<table>
<thead>
<tr>
<th>Filter name</th>
<th>NoTox L3</th>
<th>NoTox L6</th>
<th>NoTox L8</th>
<th>NoTox L10</th>
<th>NoTox L10</th>
<th>NoTox L13</th>
<th>NoTox L20</th>
</tr>
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<tbody>
<tr>
<td>Substrate Code - segment numbers</td>
<td>F/820-1</td>
<td>F/820-4</td>
<td>F/820-7</td>
<td>F/820-7</td>
<td>F/820-7</td>
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<td>F/820</td>
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<tr>
<td>Filter dimensions - radius x length</td>
<td>R70xL150</td>
<td>R95xL205</td>
<td>R115xL205</td>
<td>R115xL205</td>
<td>R115xL205</td>
<td>R125xL205</td>
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<td>Actual filter radius - mm - *</td>
<td>72</td>
<td>95</td>
<td>115</td>
<td>115</td>
<td>127</td>
<td>127</td>
<td>143</td>
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<td>Internal interface width - mm - *</td>
<td>6.00</td>
<td>3.00</td>
<td>3.00</td>
<td>3.00</td>
<td>3.00</td>
<td>3.00</td>
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<tr>
<td>Unit diameter, incl interface - mm</td>
<td>144</td>
<td>190</td>
<td>230</td>
<td>230</td>
<td>254</td>
<td>254</td>
<td>289</td>
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<td>Substrate length - mm - *</td>
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<td>205</td>
<td>205</td>
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<td>Channel effective length - mm</td>
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<td>Unit weight - kg - measured - *</td>
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<td>5.90</td>
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<td>7</td>
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<td>Filter substrate diameter - inch</td>
<td>5.67</td>
<td>7.48</td>
<td>9.06</td>
<td>9.06</td>
<td>10.00</td>
<td>10.00</td>
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<td>Filter length - inch</td>
<td>6.06</td>
<td>8.07</td>
<td>8.07</td>
<td>10.04</td>
<td>8.07</td>
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<td>Wall thickness - mm - fixed</td>
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<td>Wall thickness - 1/1 inch</td>
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<td>0.031</td>
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<td>0.031</td>
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<td>65</td>
<td>79</td>
<td>79</td>
<td>87</td>
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<td>Cell spacing Center to Center - mm</td>
<td>2.88</td>
<td>2.74</td>
<td>2.84</td>
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<td>Open side Width per Cell - mm</td>
<td>1.88</td>
<td>1.94</td>
<td>2.04</td>
<td>2.04</td>
<td>2.05</td>
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<td>Inlet cell Cross Section - mm²</td>
<td>3.53</td>
<td>3.76</td>
<td>4.14</td>
<td>4.14</td>
<td>4.20</td>
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<td>Total Cell Cross section - mm²</td>
<td>8.29</td>
<td>7.50</td>
<td>8.04</td>
<td>8.04</td>
<td>8.13</td>
<td>8.13</td>
<td>6.59</td>
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<td>Filtration area per Cell - mm²</td>
<td>1.143</td>
<td>1.574</td>
<td>1.653</td>
<td>2.060</td>
<td>1.665</td>
<td>2.075</td>
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<td>Filter unit total front face - cm²</td>
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<td>283.53</td>
<td>415.48</td>
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<td>506.71</td>
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<td>102</td>
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<td>119</td>
<td>119</td>
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<td>Internal interface ring area - cm²</td>
<td>0.00</td>
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<td>7.54</td>
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<td>Internal interface cross area - cm²</td>
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<td>46</td>
<td>28</td>
<td>28</td>
<td>30</td>
<td>30</td>
<td>51</td>
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<td>Lost front face/total front face - %</td>
<td>0.00</td>
<td>21.40</td>
<td>8.46</td>
<td>8.46</td>
<td>7.50</td>
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<td>Interface volume - ccm</td>
<td>0.00</td>
<td>123.18</td>
<td>71.33</td>
<td>88.90</td>
<td>77.16</td>
<td>96.18</td>
<td>215.95</td>
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<td>Number of substrate cells - *</td>
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<td>3.241</td>
<td>4.929</td>
<td>4.929</td>
<td>5.681</td>
<td>5.681</td>
<td>8.889</td>
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<tr>
<td>Number of inlet filter cells -</td>
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<td>1.621</td>
<td>2.465</td>
<td>2.465</td>
<td>2.841</td>
<td>2.841</td>
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<td>Inlet cells per cm² - numbers</td>
<td>12.06</td>
<td>13.34</td>
<td>12.44</td>
<td>12.44</td>
<td>12.31</td>
<td>12.31</td>
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<td>Inlet cells per inch² - numbers</td>
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<td>86.03</td>
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<td>79.40</td>
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<td>Inlet cell volume - ccm</td>
<td>497.1</td>
<td>1.236</td>
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<td>2.583</td>
<td>2.425</td>
<td>3.022</td>
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<td>Effective total filtration area - cm²</td>
<td>1.057</td>
<td>2.551</td>
<td>4.079</td>
<td>5.077</td>
<td>4.730</td>
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<td>Filter Unit effective volume - ccm</td>
<td>2.508</td>
<td>5.689</td>
<td>8.446</td>
<td>10.506</td>
<td>10.310</td>
<td>12.825</td>
<td>19.379</td>
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<tr>
<td>Specific Filter Unit area - m²/litre</td>
<td>0.42</td>
<td>0.45</td>
<td>0.48</td>
<td>0.48</td>
<td>0.46</td>
<td>0.46</td>
<td>0.49</td>
</tr>
</tbody>
</table>
Innovative features

Pressure drop which is one of the worst enemies of the soot trap is helped greatly with this simple, well proven and reliable technique. In order to convert the Flow Through Monolith to a Wall Flow Filter every second channel must be closed in order to comprise a coextending throughgoing passage separated by the wall.

The main principle of the NoTox design is to avoid relying on the insertion of additional material into the filter body, also known as a plug, but rather to close the passage by means of material already present in the form of parts of passage walls adjacent to the passage.

This technique insures that the effective substrate length is the same as the substrate. In other terms, the filtration area is not reduced by conventional plugging methods. Avoiding a loss of filtrating substrate length of two times app. 8 mm on a 205 mm long trap is equivalent to as much as 8% filtration area.

An extra feature is that comparison of Corning and NoTox monolith front face inlet flow characteristics with different channel closing methods shows a most interesting results. The NoTox channel closing and manifolding method causes considerably less turbulens resulting in a 25% less pressure drop over the monolith, plotted against the linear filter wall face velocity.

Comparison of monolith front face inlet flow characteristics of Corning and NoTox channel closing methods. The NoTox channel closing, manifolding method causes less turbulens resulting in a 25% less pressure drop over the monolith inlet face, plotted against the linear filter wall face velocity.

Channel closing
System technology

Fuel Additives

Catalytically active fuel additive tests on NoTox filters show very fine results. NoTox WFF has the advantage of having higher thermal conductivity and capacity which evens out the exothermal harmful reactions compared to Cordierite traps. The result is a gentle reaction giving a more uniform filter temperature and regeneration with absolutely no temperature peaks. There is no possible melting problem associated with the NoTox SiC trap.

- Iron oxide based additives are currently undergoing large scale tests in field trials with very good results.
- Cerium based additives have been tested in our engine lab with interesting results that depend on stochastic behaviour.
- Copper based additives have been tested in the engine lab as well as in many field trials and show very promising regeneration temperatures in the range of 300-380°C.

Corrosion resistance of NoTox SiC substrates is advantageous and different compared to Cordierite at elevated temperatures, important for long time use in connection with lubricating oil and fuel additives. All additives will eventually block up the filter and in high temperature spots react with themselves or the trap material. If any chemical reaction between powdered ash and trap material takes place, periodic cleaning of the trap becomes impossible. Problems associated with long time durability caused by non-removable ash accumulation in Cordierite filters are associated with the melting point (~950°C) of a typical ash composition. As the low thermal conductivity and thermal capacity of the Cordierite material cause high temperature spots during un-controlled regenerations, the ash melts in various places over a period of time forming a non-removable solidified surface on the filter wall.

NoTox SiC WFF with high thermal conductivity and capacity completely eliminates problems associated with hot spots. The NoTox trap has not experienced problems with molten ash.

Multi-Trap

Retro-fit of filter systems to replace popular, relatively small diameter and long length, mufflers with a diesel particulate WFF system produces a problem associated with current WFF technology. The best one piece WFF substrate ratio diameter/length is between 1:1 and 1:1.4. Therefore, it is rather difficult to reach sufficient filtration area and substrate volume with limited muffler diameters.

Multi-Trap is a method and system set-up with nearly unlimited substrate volume designed to replace most slim-line mufflers.

Oil burner heated system

For some vehicle set-ups a burner regeneration system performs best. A NoTox 2×L24 prototype with a total of 48 litre trap volume for off-duty diesel oil burner regeneration has been successfully mounted since 1994 and tested by DSB in Denmark on a Deutz V12 industrial engine powered Plasser Unimatic rail road construction vehicle. The system was produced with 25 µm pore size giving app. 40 hours of operation before off duty cleaning and offering >90% filtration efficiency.

PM Coatings

Precious Metal catalytic coatings for reduction of the soot oxidation temperature have been tested in the laboratory. The largest effort was put into the important wash-coat where a basic alumina coating technique with good adhesion and large surface has been developed. NoTox Corp. will supply further information on request.

Further information about Delta and Carry on request.
How to order

Explanation of the product code

Example
NoTox L6-Ø190×L205-F820-4-SF

L6 = substrate volume in litre
Ø190 = diameter of the substrate
L205 = length of the unit
F820 = material code describing the pore size
4 = number of segments selected to create the filter block
SF = Semi-Finished
FF = Fully-Finished

Present standards
• Material F-820 equivalent to 25 µm pore.
• Wall thickness either 0.8 mm or 1 mm.
• Channel width: 1.8 or 2.0 to 2.5 mm.

Soot limit:
The safe soot limit depends on several dimensional factors, the three most important being:
• Number of substrate segments
• Substrate segment length
• Ratio between diameter and length

Increasing segmentation numbers and decreasing substrate length easily increase the safe soot limit to above the possible amount of soot particles being possible to pack into the total channel volume. Currently NoTox substrate with diameter <190 mm has a maximum of four segments, and diameter >228 mm has preferably seven segments. Generally speaking, as the NoTox trap shows considerably more gentle or slower response to uncontrolled exothermic reactions, the maximum safe soot limit has a different meaning compared to the Cordierite trap.

Square root of permeability (Darcy) plotted as a function of pore sizes in different materials.
Sizing

Basics
NoTox products feature half the clean trap pressure drop compared to equivalent Cordierite based WFF and just as important considerably less back pressure increase during the soot layer build up. All in all this will result in:
- Smaller traps or lower engine back pressure
- Easier to fit into the engine compartment
- Because of the above less temperature drop before the trap

Mounting soot traps involves considerable knowledge and experience. Please seek further information in relevant SAE articles and from actual tests.

Base the choice on the following four criteria:
- Is the vehicle suitable for the purpose
- Type of regeneration principle
- Drive cycle, number of daily shifts
- Engine type, volume flow

Additive based regeneration
The three commonly available additives show different properties and demand trap / engine sizing. The following general rules are based on tests with prescribed Copper and Ferrum additive amounts in connection with <50 ppm Sulphur content fuel.

Small Engines
Suitable trap size for natural aspirated diesel engine based on a NoTox WFF system with sequential regeneration is:
- One filter litre for one litre engine displacement

Large Engines
Suitable trap size based on a NoTox WFF system with sequential regeneration during operating on larger engines with displacement from 4-15 litre is:
- 1-1\1/2 filter litre / litre engine displacement for natural aspirated engines
- 1\1/2-2 filter litre / litre engine displacement for turbo charged depending on boost pressure / volume flow

Off duty regeneration
Based on accumulation of the soot during the total drive cycle and regeneration by external heating the filters must usually be twice the size described above.

Warning
In order to protect the engine and eliminate excess fuel consumption the following important cases must be avoided:
- Too large engine backpressure, no more than 250 mBar in absolutely worst case scenario
- Too large distance from the engine, metre >1
- Worn out insulation, insure good insulation protection
- Vibration transfer to the filter, use flexible joints, pipes etc.
The final NoTox product

Basic substrate product

Non-canned raw substrate set as delivered. Includes the internal interface in between the segments regardless of segment numbers.

Each set will be shipped covered in strained plastic wrap to be wrapped directly with the external interface without removing the plastic wrap. Cut off excessive wrapping prior to customer heat treatment. The remaining wrapping burns away during the heat treatment of the possible surrounding Interam interface.

This technique is used in order to prepare the canning processes and to insure substrate protection during handling.

Semi-Finished product

Semi-Finished filter module canned with a suitable 12 mm external fibre insulating interface inside AISI 304 1.5 mm thick rolled sheet pipe with 2 pcs. MIG welded steel L-rings, the system being app. 30 mm longer than the substrate. The product is delivered heat treated in order to remove organic binder from the interface. This treatment oxidizes the outside face of the can to a light brown colour.
SF-Electrically-Heated Prototypes

Semi-Finished-Heated prototype filter unit inside AISI 304 stainless steel 1,5 mm thick rolled sheet pipe with selectable length. L-ring may be removable, as shown also on STS picture, and is integrated with the inlet/outlet cones for easy system disassembling. This product is only available in close cooperation with the system manufacturer.

The supplied pre-shaped pipe heating element with AISI 316 or Inconel shield is retractable from the four, five or seven segments substrate set without any disassembling of the filter module. The segments are separated by profiled knitted wire mesh guides. The slots between the segments for the heating element are app. 7-9 mm wide.

Fully-Finished

Fully-Finished units inside AISI 304 stainless steel 1,5 mm thick rolled sheet pipe with selectable length and inlet cone sizes, flanges / adaptors, extra insulation and heat shields. The L-ring is integrated with the inlet/outlet cones and diffuser. The product is delivered heat treated in order to remove organic binder from the interface.
NoTox Business Concept

Company Strategy

Together with the Danish Technical University over the past 10 years NoTox Corporation and Stobbe Technologies have developed methods, know-how, techniques, manufacturing techniques and production equipment for the manufacturing of a variety of barrier filters for hot gas cleaning.

NoTox Corp. offers the following »software«
• Innovation in hot gas filtration
• R & D collaboration
• Special substrate production
• Licensing of system design

NoTox Corp. offers the following »hardware«
• NoTox ceramic WFF substrate set
• NoTox Semi-Finished WFF modules
• NoTox Fully-Finished WFF modules

– in the area of diesel engine exhaust filter system parts for the diesel engine industry. Completely finished products are produced in cooperation with other parties.

Customer Support

As an extra service for OEM and system manufacturers, NoTox Corp. are proud to offer a series of patent protected methods, system designs and regeneration techniques. Please contact NoTox Corp. for CAD drawings, etc. and further discussion under a secrecy agreement.

NoTox Corp. presents reliable technical information concerning the described products and the use of the products.
• The product is delivered according to specification
• Delivery time depends on the actual product

However:
• All advice concerning the selection and the use of any products is provided with no warranty
• NoTox Corp., Stobbe Engineering A/S or Stobbe Technologies assumes no responsibility for any patent liability arising from the use of any product in a process, manner, or formula
• Nothing in the listed information shall be construed as an inducement or recommendation to use any process, procedure or product in conflict with existing or future patents
• All warranties of merchantability and fitness of purpose are disclaimed
• In certain countries NoTox WFF substrates with a mean pore size between 20 m and 55 m should not be used for passenger cars or passenger cars derivatives capable of seating 12 passengers or less, also know as light-duty vehicles, without the prior consent of Corning Inc.

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References and Supporting Products

References

3. Høj, Jakob W.; Stobbe, Per; Sorenson, S.C. – »Thermal loading of SiC particulate filters«, SAE paper 950151.

Supporting Products

Substrate interface
Catalytic Support Systems Ltd
Knitwire Products
Phone: +44 925 265655
Fax: +44 925 264995

3M Europe GmbH
Interam® products
Phone: +49 2131 14-0
Fax: +49 2131 142626

Flame glow plugs
BERU Ruprecht GmbH & Co. KG
Phone: +49 7141 132-0
Fax: +49 7141 132-350

Heating elements
BACKER Elektro-Värme AB
Phone: +46 451-661 00
Fax: +46 451-614 37

Connectors
Electrical/pneumatic in one
ODU Kontakt GmbH & Co
Phone: +49 8631 6156-0
Fax: +49 8631 6156-49

Exhaust system insulation
TIGHITCO Inc.
Phone: +1 404 355 1205
Fax: +1 404 351 4458

Graphite/steel composite gaskets
Elwis Royal A/S
Phone: +45 45 87 72 55
Fax: +45 45 87 72 66