

*"Mention of any company name or product does not constitute endorsement by MSHA."*

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MNM DPF Selection Guide was last updated on *February 20, 2003*

# **Diesel Particulate Filter Selection Guide**

## **for**

### **Diesel-powered Equipment in Metal and Nonmetal Mines**

Welcome to the Compliance Assistant for controlling DPM emissions of diesel-powered equipment used in nongassy metal and nonmetal mines. The Compliance Assistant will assist you in selecting the proper [diesel particulate filter \(DPF\)](#) that is designed to work in hot engine exhaust. These DPFs have also been called "soot traps," or just "traps." They are distinct from and not to be confused with the disposable "paper" filters that are used for filtering the cooled exhaust of mine equipment operating in potentially explosive atmospheres (permissible equipment). Disposable paper filters can also be used in MNM applications if the exhaust is cooled. [Note: As of this writing, a disposable-reusable filter using a pleated element capable of withstanding hot diesel exhaust is being tested by the coal industry. Neither the filtration efficiency, loading capacity, nor number of reuses is known at this time. This document does not reflect this new filter as an option.]

The Compliance Assistant is assuming that you arrived at this selection guide because a specific piece of diesel-powered equipment (usually a vehicle) has been selected (targeted) for reduction of its tailpipe [DPM](#) emissions perhaps as a result of using the [MSHA MNM Estimator](#). Equipment becomes targeted for emissions reduction when compliance cannot be achieved by ventilation alone, and the required reduction of DPM (measured as total or elemental carbon) is substantial, say greater than 50%. If you have arrived at this guide, and it does not appear to be what you need, use the Back button of your browser to return.

### **How this document works**

The Compliance Assistant is designed to function as an interview. It is divided into several sections and within each section, the Compliance Assistant will ask you a series of questions or offer you alternatives to which you can respond by selecting (clicking the left mouse button) the appropriate highlighted word or phrase. Your response will lead you to the next question, an explanation, or to guidance on what you may need to do next so that you can select and successfully use a DPM filter on the target equipment. You will be provided with an opportunity to read why each question is asked from which you can learn its relevance to the selection of the DPM filter for your application. Pop-up windows are used to display responses to the questions when it does not lead directly to another question. You should scroll down through the text in the pop-up window until you reach a close window button which signifies the end of the relevant text. The links to the full text of supporting documents for the MNM Selection Guide can be found [here](#) (use your browser's back button to return) where they can be opened for reference and printing. Each piece of diesel powered equipment is different, and it is best, until you become familiar with the technology and its application, to start at the beginning of the Compliance Assistant for each piece of equipment that needs a DPM filter. This particular piece of equipment is your "target" equipment for this interview.

If you are not familiar with diesel particulate filter technology, the Compliance Assistant highly recommends that you read the [diesel particulate filter \(DPF\) technologies](#) before proceeding.

### **DPF Implementation Management**

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**Are you, or has your mine or company, designated a person who has overall responsibility for the implementation of DPF technology for this and all other diesel-powered equipment targeted for installation of a DPF? In other words is there a site champion?**

[Yes](#)

[No](#)

[Don't know](#)

[Why is a site champion needed?](#)

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## Questions About the Diesel Engine Condition

Successful application of DPFs requires that the engine be in good mechanical condition. An [Emissions-based Maintenance Program](#) provides the optimum means to ensure productive, low emissions operation of your diesel powered equipment.

The Compliance Assistant will assist you in making this determination about your engine, and, if necessary, provide you with guidance for making the necessary measurements or engine repairs. If the equipment is newly purchased you should still check the condition of the engine.

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**Is the engine in the vehicle selected for a DPF a two-stroke engine?**

[Yes](#)

[No](#)

[Don't know](#)

[Why is the type of engine important?](#)

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Is the engine consuming or burning crankcase oil?

[Yes](#)

[No](#)

[Don't know](#)

[Tell me why this question is important.](#)

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**Do you know the carbon monoxide (CO) concentration in the raw exhaust of the target engine?**

[Yes](#)

[No](#)

[Why do I need to know the CO level in the exhaust?](#)

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**Is the carbon monoxide (CO) level in the raw exhaust at an acceptable level for the target engine?**

[Yes](#)

[No](#)

[Don't know](#)

[Why should CO levels be acceptable?](#)

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## Diesel Particulate Filter Selection

The exhaust temperature is the major factor for determining the DPF options that will work successfully on the target equipment, and in particular, whether a passive DPF system is applicable.

The next series of questions addresses two tasks: that of getting temperature traces for the target vehicle and that of the analysis of the temperature traces.

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Selecting the appropriate DPF requires full-shift exhaust temperatures profiles/traces for the target vehicle. They should represent the full range of work scenarios performed by this equipment. Select an option below.

<a href="#">I have temperature profiles.</a>	<a href="#">Why are exhaust temperature traces needed?</a>	
<a href="#">I will get them myself or assign this task to someone in the company; tell me how.</a>	<a href="#">I will use a DPF supplier or consultant to get exhaust temperatures.</a>	<a href="#">Compare the options and help me choose.</a>

You now have exhaust temperature traces/profiles for the target equipment. You now need to decide what to do with them. Below are your options. The Compliance Assistant will provide guidance whichever one you choose. Feel free to explore these options.

Select an option for the analysis of exhaust traces/profiles of the target equipment.

<a href="#">I want to analyze the traces myself. Give me some help.</a>	<a href="#">I will give the temperature data to DPF suppliers or a consultant for their use in selecting a DPF for my equipment.</a>
<a href="#">I know the results of temperature analysis and know the critical temperature or have a DPF system recommendation. Go to the next step.</a>	

I have been given a DPF system recommendation or have determined the critical exhaust temperature,  $T_{30\%}$ , for the target equipment. Based on this information, select an option below:

I know $T_{30\%}$	I have a DPF recommendation
$T_{30\%}$ is <a href="#">greater than 325° C (625° F)</a>	<a href="#">A "passive" DPF system has been recommended.</a>
$T_{30\%}$ is <a href="#">less than 325° C (625° F)</a>	<a href="#">An "active" DPF system has been recommended.</a>

## Passive DPF Systems

The critical exhaust temperature,  $T_{30\%}$ , is greater than 325° C (615° F) or a passive regenerating DPF system has been recommended. There are several options for a passive DPF depending on the critical temperature. These temperatures are approximate and only to be used as a guide.

*Note: All active regenerating DPF systems ([go there](#)) will also work, but the active regeneration may not be required frequently or at all.*

Click on the links below to learn more about a particular passive system option or its implications.

$T_{30\%}$ exceeds ..	DPF System Options	Considerations
500° C (932° F)	<a href="#">Un-catalyzed "bare" DPF</a> or any system below.	<a href="#">Un-catalyzed DPF</a>
420° C (788° F)	<a href="#">Base Metal Catalyzed DPF</a> or any system below.	<a href="#">Base Metal Catalyzed DPF</a>
365° C (690° F)	<a href="#">Lightly Catalyzed DPF</a> with fuel additive or the system below.	<a href="#">Cat DPF Plus Additive Considerations</a> <a href="#">Installation Considerations</a>
325° C (615° F)	<a href="#">Heavily Catalyzed DPF</a>	<a href="#">Heavy Cat DPF Considerations</a> <a href="#">Installation Precautions</a>
<a href="#">Common Installation Considerations</a>		

[Closing remarks](#)

## Active DPF Systems

DPF Regeneration Location	Extended Characterization	Considerations	Installation Help
<a href="#">Off-board Regeneration</a>	<a href="#">DPF Exchange or Swapping</a>	<a href="#">Read</a>	<a href="#">Go there</a>
<a href="#">On-board Regeneration</a>	<a href="#">On-board Controller</a>	<a href="#">Read</a>	<a href="#">Go there</a>
	<a href="#">Off-board Controller</a>	<a href="#">Read</a>	<a href="#">Go there</a>
<a href="#">Common Installation Considerations</a>			

[Closing remarks](#)

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## Closing Remarks

If you have questions, comments, corrections to the Compliance Assistant for the selection of DPFs for diesel equipment used in underground MNM mines, contact the following:

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or [Aleksandar Bugarski](#)

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You are also encouraged to join the "Diesels-Underground" email discussion group. You can join the "Diesels-Underground-I" list server by sending an email message to [listserv@listserv.cdc.gov](mailto:listserv@listserv.cdc.gov) with the following line as the only line in the body of the message:

JOIN DIESELS-UNDERGROUND-L *your name*

where you substitute your name for *your name* in the line. Try to eliminate any other text in the body of the message (signature lines, etc.)

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## List of MNM DPF Selection Documents

The following documents portions of which appear in the pop-up windows can be viewed and printed in their entirety by selecting the links below. Use the back button to return here.

[Questions \(this document\)](#)

[Explanations document](#)

[Actions document](#)

[Glossary](#)

[MNM FAQs](#)

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## References and Information Sources

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NIOSH

Review of Technology Available to the Underground Mining Industry for Control of Diesel Emissions ( 1924 KB )

Schnakenberg GH Jr., Bugarski AD [2002]

Pittsburgh, PA: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and

Health, DHHS (NIOSH) Publication No. 2002-154, IC 9462  
<http://www.cdc.gov/niosh/mining/pubs/pdfs/ic9462.pdf>

Performance Evaluation of Diesel Particulate Filter Technology in the Underground Environment (624 KB)

McGinn S, Grenier M, Bugarski A, Schnakenberg GH Jr., Petrie D [2002]  
In: De Souza E, ed. Proceedings of the North American/Ninth U.S. Mine Ventilation Symposium  
(Kingston, Ontario, Canada). Lisse, Netherlands: Balkema, pp. 433-440  
<http://www.cdc.gov/niosh/mining/pubs/pdfs/peodp.pdf>

An Emissions-Assisted Maintenance Procedure for Diesel-Powered Equipment -- University of Minnesota

<http://www.cdc.gov/niosh/mining/eamp/eamp.html>

Emissions Based Maintenance - DEEP Report

[Instructors Manual](#)  
[Mechanic's Manual](#)

Information on the research of DEEP (Diesels Emissions Evaluation Program)

<http://www.deep.org/>

The web site [DIESELNET](#) is a wealth of current and archival information. An Technology Guide, available to subscribers, is an excellent source for the scientific and technical underpinnings of diesel emission control technologies. It is well worth the nominal subscription fee.

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## Acknowledgments

*This document was authored by George Schnakenberg, Jr. of NIOSH and in consultation with Aleksandar Bugarski, also with NIOSH, It was reviewed by Larry Patts of NIOSH and James Angel of MSHA. It represents the state of knowledge at the time of writing. Please address any comments about this document to [George Schnakenberg, Jr.](#), NIOSH-PRL, P. O. Box 18070, Pittsburgh, PA 15236, 412-386-6655.*