FEROX®
CLEAN HYDROCARBON TECHNOLOGY

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The Effects of Ferox on NO_X

The formation of NO_X appears to take place late in the combustion process during the exhaust phase and is influenced by available excess oxygen, high temperatures and time duration. By combining what has been learned from tests concerning the effects of Ferox on NO_X, and an understanding of how Ferox affects combustion chemistry in general, a good model of how Ferox affects NO_X emissions has been produced. This model has been used very successfully to predict the trend in NO_X production in both internal combustion engines and open flame boilers.

One of the results observed while monitoring the effects of Ferox on general emissions is wide fluctuations in the amount of NO_X produced. Over time these fluctuations have always shown a downward trend that correlates to the removal of deposits. The fact that deposits directly affect the factors responsible for the formation of NO_X support a direct connection between NO_X emissions and deposits. This connection is further supported by the fact that a clean engine running on Ferox treated fuel produces very low amounts of NO_X. The process by which Ferox inhibits the formation of NO_X is a direct result of the process by which it destroys and inhibits the formation of deposits, namely through the promotion of CO_2 production. The following is a general explanation of how Ferox affects the three main factors that promote the formation of NO_X.

Fuel has a limited amount of energy that is released through the production of CO_2. Ferox promotes the formation of CO_2 during the combustion phase. If more CO_2 or energy is released during the combustion phase then less is available to be released during the exhaust phase. The difference in the amount of energy released during the two phases correlates to a temperature difference. This temperature difference, its magnitude and cause are important for three reasons.

First, cooler exhaust. If the temperature of the combustion phase rises due to increased CO_2 production then the temperature of the exhaust phase will go down due to a decrease in CO_2 production. This denies the nitrogen molecules the high temperatures needed to form NO_X compounds during the exhaust phase of the combustion process. The lower temperatures slow the production of NO_X by requiring more time for the reactions to take place. The greater the difference in the energy released and the associated temperature difference, the cooler the exhaust and the slower the rate of NO_X production.

Second, a quicker heat transfer time. The greater the magnitude of the temperature difference the quicker the heat transfer time becomes. This allows more of the heat to be transferred to the surrounding engine components in a given moment and in and of itself will contribute to lower exhaust temperatures as discussed above. More importantly this decreases the time duration in which high temperatures are available for the conversion of nitrogen to NO_X compounds. The shorter the time duration the lower the NO_X emissions.

Third, the cause of the first two, namely the production of CO_2, uses up more of the available oxygen. Due to the fact that Ferox promotes the production of CO_2 during the combustion phase, less oxygen is available for NO_X reactions during the exhaust phase. Less available oxygen results in lower NO_X emissions.

The combination of lower exhaust temperatures, quicker heat transfer and less available excess oxygen along with the removal of deposits, causes a noticeable reduction in the amount of NO_X emissions produced.

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