

“Rust”

Tony Cripps

Owners may have noticed that the front section of their exhaust pipe is seldom observed to be rusted out because it usually gets hot enough to drive off the water in the exhaust gases before serious rust can take hold. It is the rear sections (usually the rear muffler), that remain relatively cool that are first to go due to condensation of water on the inside. However, what is curious is that the mufflers and tailpipes, which usually rust out from within, generally have a non-rusty appearance from the outside whereas the front section usually appears very rusty from the outside, but remains relatively sound for many years. Why is this so?

The front section of the exhaust, particularly the exhaust manifold, gets very hot compared to the remainder of the exhaust system. Rust (iron oxide) is the combination of iron, water and oxygen. As with many chemical reactions, there is usually an energy barrier to be overcome before the reaction proceeds. In the case of rust, the water and oxygen molecules have to prise out an iron atom from the metal before iron oxide is formed. This takes energy. When the metal is hot, its atoms are jiggling around much more violently compared to when the metal is cool. Thus, hot metal rusts more easily than cool metal because the iron atoms in the hot metal are already somewhat loosened by their thermal motion and so the water and oxygen molecules find these atoms easier to combine with to form rust. This very heat drives off the water needed to form rust and so only light, but very visible, rust occurs. The muffler and tailpipe generally do not show signs of rust from the outside, but rust heavily from within due to the condensed (and sometimes stagnant) water present.

Much the same effect happens when metals are bent or otherwise distorted. For example, you will find rust begins more easily on creases in steel body work, or where there has been welding done, because of the deformation of the metal causes atoms to be displaced from their usual positions and become less well bonded – and so are more amenable to being captured by water and oxygen to form rust. Most of us may remember the effect from our school days when we put a bent nail in a jelly solution containing acid and observed the corrosion in the vicinity of the bend rather than at the straight parts.

It behoves us then, as enthusiastic owners, to avoid heating and bending metal parts so as to avoid the onset of rust at these locations.

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