Fuel Right

Nozzle Plugging and Fuel Instability

Nozzles plug for either of two reasons: 1) sludge fouling or 2) degraded fuel particles. You can tell the difference as follows:

Sludge fouling is the classic cause of plugging of everything: filters, lines, strainers and nozzles. Sludge fouling is seen as a shiny (when wet with fuel) black buildup. If you rub a little of this stuff between your fingers it has a sticky, almost grease-like consistency when wet with fuel oil. As the fuel slowly dries out it gradually thickens until it finally feels like “dirty wax”. It never becomes dry and crumbly.

Sludge fouling usually effects not only the nozzle, but all other parts of the system as well. It can grow in any grade of heating oil or diesel fuel, and is prevented by using Fuel Right treatment.

If you find that the filter and strainer, as well as the nozzle, are similarly fouled, then it is probably sludge fouling. If you have this problem, it might also be masking the second type of nozzle plugging, which is…

Degraded fuel particles. These form a *dull, non-shiny* black-to-brown deposit. When wet with fuel oil this stuff feels very slippery with almost no body – almost like a graphite/oil lock lubricant. As it dries out it turns to a dry, crumbly solid that turns to black dust when rubbed between your fingers.

These particles are formed when unstable fuel oil is heated at or just ahead of the nozzle each time the burner cuts off. It is usually found on air heaters or chambered boilers – rarely on unchambered boilers. If you are treating with Fuel Right and have fouled nozzles, you will probably find that your filters and strainers are basically clean, and you have a classic case of fuel thermal instability.

Fuel Right treatment will not help with this problem. In fact we have not found any chemical solution to this one. There are two know cures. One is to switch to a fuel with better thermal stability, such as dyed low-sulfur diesel fuel. The other is to add a 2-minute post purge to the burner to prevent nozzle heat-up upon shutoff.

Incidentally, using low-sulfur No. 2 is not a guaranteed fix, but rather a big improvement over “average” high-sulfur No. 2. There is currently no good test for this property in fuel oil that is accepted by the industry. We developed a test and will be working to get industry acceptance over the next couple of years.Until such a test is included as part of the fuel specification, it is unlikely that you will see an overall improvement in this aspect of fuel quality.

Below are two fouled nozzle pre-filters. The one on the left is fouled with degraded fuel particles. The one on the right is fouled with biologically active sludge. Note its shinier appearance.

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