

HAZARDS & DIFFICULTIES OF BURNING USED OILS

In order to achieve a significant contribution to environmentally clean combustion, it is necessary to convert through combustion all of the carbon and hydrocarbon molecules of the base oil and the sludge to the gaseous form of carbon dioxide, water and **heat**. There are many substances in waste oil which are not combustible and which cause substantial environmental and combustion concerns, particularly when associated with unburned organic residue associated with incomplete combustion. Automotive engine oil is highly viscous and contains many additives to meet lubricating requirements. However, this viscosity causes difficulty in heating the oil to ignition temperature, as well as in obtaining small particle atomization for proper combustion.

In continuation of this problematic review, it should be noted that chemical breakdowns occur in the synthetic additive polymers as well as the base oil molecules. Many different contaminants are generated by the engine itself, such as: unburned fuel, water, acids, sludge, road dust, antifreeze and many different wear metals. Due to the high amount of detergents used in automotive oils, the contaminants are retained in suspension and are thus removed from the engine at normal oil change and must be considered throughout the preparation for combustion and combustion itself. In addition, the oils collected from winter driving will significantly differ from those of summer driving. Preheating is absolutely necessary and, this in itself, introduces numerous related problems:

1. Heating oil at through velocities of less than one foot per second will cause nucleate boiling with related graphite precipitation into nozzle blocking nodules.
2. The waste oil contains air, water and gasoline in solution that will gas-off during the heating process. The gas will interrupt the steady flow of oil to cause erratic and dirty combustion.
3. Pressure regulation is required to maintain uniform firing rates. This is difficult due to the extreme variations in viscosity and the low flow rates involved. The problems of pressure regulation are magnified with the entrained vapors to give pulsating pressure and erratic and/or dirty combustion.

Black dirty combustion is prevalent in the waste oil industry, as is an incidence of explosions. The industry standard is now Underwriter's Laboratory 296A that, in our opinion, gives rise to the opportunity for misfire and explosion. In particular, UL296A allows use of a primary combustion control that uses a cadmium light sensor and includes a safety timing of 45 seconds. That means that for up to 45 seconds hot fuel can be pumped into a furnace. Not only is that unsafe, but can make a mess with pooled up unburned oil. In particular, this type of primary safety control is prevalent in the residential oil furnace industry, and does a good job in protecting homes. However, the waste oil industry would more closely relate to an industrial application and should require appropriate safeguards.

A cadmium light sensor is responsive to daylight, incandescent or fluorescent light and, as such, can and will pick-up on random lighting to continue to deliver oil when the flame was struck out by any number of reasons. If spark ignition or flame could be subsequently re-established, the residual liquid oil in the combustion chamber could produce dire consequences. A valid list of adverse conditions could but will not be presented to elaborate the peril of using a simple residential cadmium sensor for an industrial waste oil application. The use of a 45 second timing sequence for a trial ignition period and for oil interruption upon flame interruption provides a quantity of oil that can fuel a substantial explosion under attainable conditions. The INOV8 sequence is much shorter as explained later.