ISSUE
07
April
May
June
2013

Consultant

this issue

Professional Development

System Engineering And Laboratories (SEAL) offers CE classes in various forensic Engineering subjects. To receive more information contact **marketing@sealcorp.com.**

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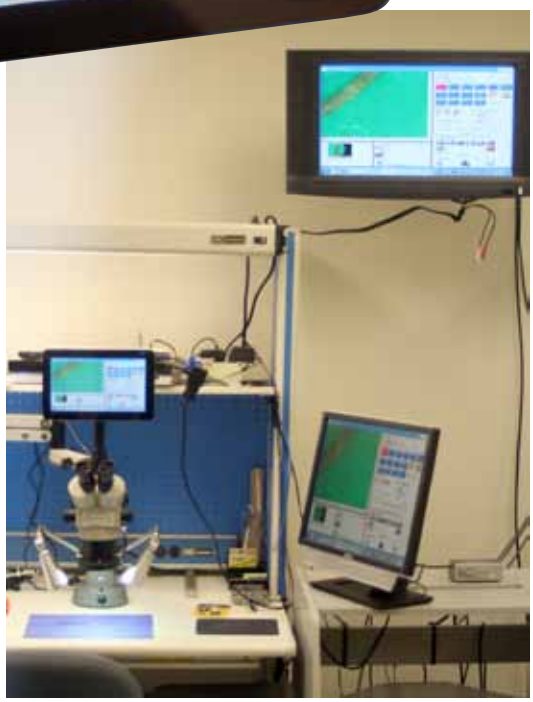
Tools of Our Trade!

In our Forensic Lab, we utilize the stereo Trinocular microscope and incorporate a state-of-the-art windows based touch pad display and imaging program. The laboratory microscopy combines the tablet PC and a digital camera, it can preview, take images, videos, and make measurements, wireless transmitting of images or internal to a SD card.



Who Created Fuel Injection?

Herbert Akroyd Stuart developed the first device with a design similar to modern fuel injection, using a 'jerk pump' to meter out fuel oil at high pressure to an injector. This system was used on the hot bulb engine and was adapted and improved by Bosch and Clessie Cummins for use on diesel engines. Fuel injection was in widespread commercial use in diesel engines by the mid-1920s.

The first use of gasoline direct injection was on the Hesselman engine invented by Swedish engineer Jonas Hesselman in 1925. Hesselman engines use the ultra lean burn principle; fuel is injected toward the end of the compression stroke, then ignited with a spark plug. They are often started on gasoline and then switched to diesel or kerosene.

German direct injection petrol engines used injection systems developed by Bosch from their diesel injection systems. Due to the wartime relationship between Germany and Japan, Mitsubishi also had two radial aircraft engines utilizing fuel injection.

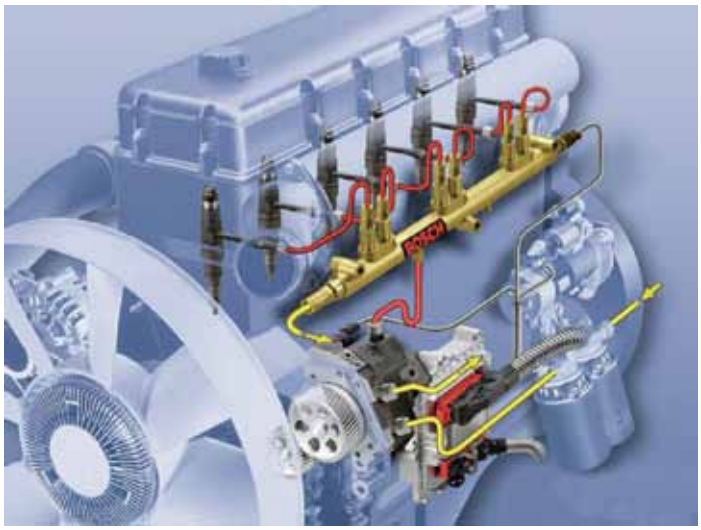
Alfa Romeo tested one of the very first electric injection systems in 1940. The engine had six electrically operated injectors and were fed by a semi-high pressure circulating fuel pump system.

continued from Consultant, no. 6

Fuel Contamination Breakdown

Brian Haygood, P.E.
Consulting Engineer

The Bosch high pressure common rail fuel systems now used in most diesel truck engines use fuel pressure hundreds of times higher than most automotive fuel systems; up to 27,000 psi. This allows tiny amounts of fuel to be atomized through small orifices in the fuel injectors at idle, but high volumes of fuel to be added when power is needed. However, those small orifices and other passages pose a problem.



The system cannot handle particles ordinarily found in fuels, and so require much better fuel filtration.

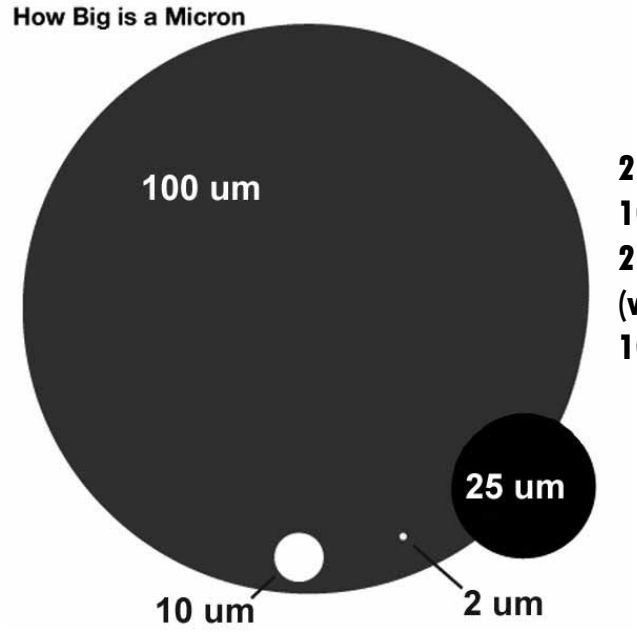
According to one technician, Bosch specified a two micron filter be used with these fuel systems (i.e. particles larger than two microns would be trapped by the filter.)

Filtering a few hundred horsepower worth of fuel down to two microns is no easy task. Some of the US truck manufacturers only used 10 micron filters; allowing particles five times larger than they should have into the fuel system.

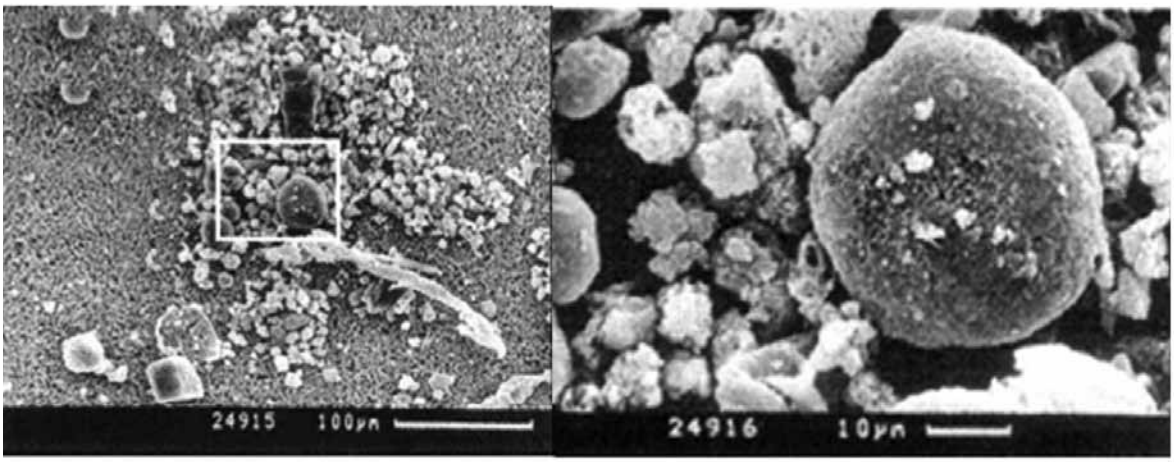
Aftermarket frame-mounted filters are available that claim better filtration and water exclusion. As of about 2009, some vehicle manufacturers started making five (5) micron filter retrofit kits, and began using five micron filters on their new production vehicles. This should correspond with fewer fuel system failures. The

newer fuel filtration systems are supposed to exclude more water as well. Unfortunately, we've seen no sign this manufacturer has started using quality materials in their fuel lines, including the "fuel connectors" inside the head of the engines. Using mild steel for these parts allows rust to form within the engine. Rust particles can then clog the fuel injectors. Even a tiny amount of water, given enough time, will cause these parts to rust, eventually causing catastrophic engine failure.

Tight Tolerances & Small Spaces



2 microns = Recommended Filter Size
10 microns = Filter Size Used
25 micron = Debris and Dust Particles (visible to the naked eye)
100 microns = Human Hair



Photomicrograph of fuel particles. Scale on left is 100 micron. Right 10 micron.

In a future blog post at ***http://sealconsultant.blogspot.com/***, we'll post some of the latest information available on this and other subjects. In the meantime, for further information please contact Mr. Brian Haygood at 903-566-1980, or bhaygood@sealcorp.com.

Diesel Engine Advantages

1. They burn less fuel than a gas engine performing the same work, due to the engine's higher temperature of combustion and greater expansion ratio. Gasoline engines are typically 30% efficient while diesel engines can convert over 45% of the fuel energy into mechanical energy.
2. They have no high voltage electrical ignition system, resulting in high reliability and easy adaptation to damp environments. The absence of coils, spark plug wires, etc., also eliminates a source of radio frequency emissions which can interfere with navigation and communication equipment, which is especially important in marine and aircraft applications.
3. The life of a diesel engine is generally about twice as long as that of a gas engine due to the increased strength of parts used. Diesel fuel has better lubrication properties than gas as well.
4. Diesel fuel is distilled directly from petroleum. Distillation yields some gasoline, but the yield would be inadequate without catalytic reforming, which is a more costly process.
5. Diesel fuel is considered safer than gasoline in many applications. Although diesel fuel will burn in open air using a wick, it will not explode and does not release a large amount of flammable vapor. The low vapor pressure of diesel is especially advantageous in marine applications, where the accumulation of explosive fuel-air mixtures is a particular hazard. For the same reason, diesel engines are immune to vapor lock.

ATF The Bureau of Alcohol, Tobacco, Firearms and Explosives

The Federal agency primarily responsible for protecting our communities from violent criminals, criminal organizations, the illegal use and trafficking of firearms, the illegal use and storage of explosives, acts of arson and bombings, acts of terrorism, and the illegal diversion of alcohol and tobacco products.

EPISODE IV

In a galaxy not so far away Federal Agencies battle and during the combat.. tax dollars vaporize.

TURF WARS

Following a residential, commercial, or vehicle fire, investigators often utilize an examination of the condition of the electrical wiring in an attempt to determine fire causation. In the past, it has been believed that an investigator can, in the field, differentiate between melting of copper wiring due to the heat of the fire and electrical shorting or arc beading of an energized copper conductor. Further, it was held that an investigator could determine whether the arc damage was a cause or an effect (“victim”) of the fire.

Frank Johnson, P.E.
President / CEO

A contract was awarded in 2010 by the Department of Justice (DOJ) to Combustion Science and Engineering, Inc. to study the difference between copper wire melting, copper wire arcing, and whether or not those differences were distinguishable. That study was completed in July of 2012. The study and testing was conducted primarily under laboratory conditions. The results reported were significant in that the researchers concluded that distinguishing between electrical arcing damage and melting could not always be accomplished. One of the results, utilizing metallography, revealed a characteristic (line of demarcation) that was present in over 40%, 6 of 14 samples of energized arc beads. However, the same characteristic was present in one (6.6%) of 15 non-energized samples. This characteristic certainly may warrant additional study.

Following the release of the study another arm of the DOJ, the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) issued a technical bulletin entitled Visual Characterizations of Fire Melting on Copper Conductors. In that paper, the ATF was critical of the study's conclusions, citing faults in both the study's methodologies and analysis.

ATF's paper non-constructively criticized the study's analysis of the damage to the conductors, pointing out that the photographs presented in the study visibly meet the criteria in the current NFPA 921 (see side bar) for arc beads.

Perhaps the more important question should be what improvements need to be made in the analysis of electrical systems in fire investigation. If it is clear that characteristics of fire damage versus electrical arcing are not always discernible by simple visual observation, more study should be done to find those uniquely identifiable characteristics. Those of us in the civilian world will be interested to see how this turf wars will plays out. ✧

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ATF Fire Research Laboratory Technical Bulletin 001 – Sept. 28, 2012. Click below to view pdf.
http://www.atf.gov/files/publications/laboratories/atf-frl-technical-bulletin-001.pdf

U.S. Department of Justice. Forensic Investigation Techniques for Inspecting Electrical Conductors involved in Fire. Document No. 239052, July 2012. Click below to view pdf.
https://www.ncjrs.gov/pdffiles1/nij/grants/239052.pdf

NFPA National Fire Protection Association

NFPA 921 Title has evolved over the course of years since its original publication, accomplished primarily through the advances of scientific investigation. One cannot simply put their head in the sand and say that visual characteristics are all that is needed to identify an arc bead any more that one can say that crazed glass means accelerants were used in a fire.

CLICK TO FOLLOW US:

Kelley M. Stalder, P.E.
Electrical Engineer

Preview 2 New CE Classes!

We have two new CE Classes available for the new year. Below are descriptions of both available as 1, 2, or 3 hour, (Texas accredited courses). Other state accreditations are available upon request.

Electrical Arcing: Is it the Culprit, a Collaborator, or a Non Sequitur?

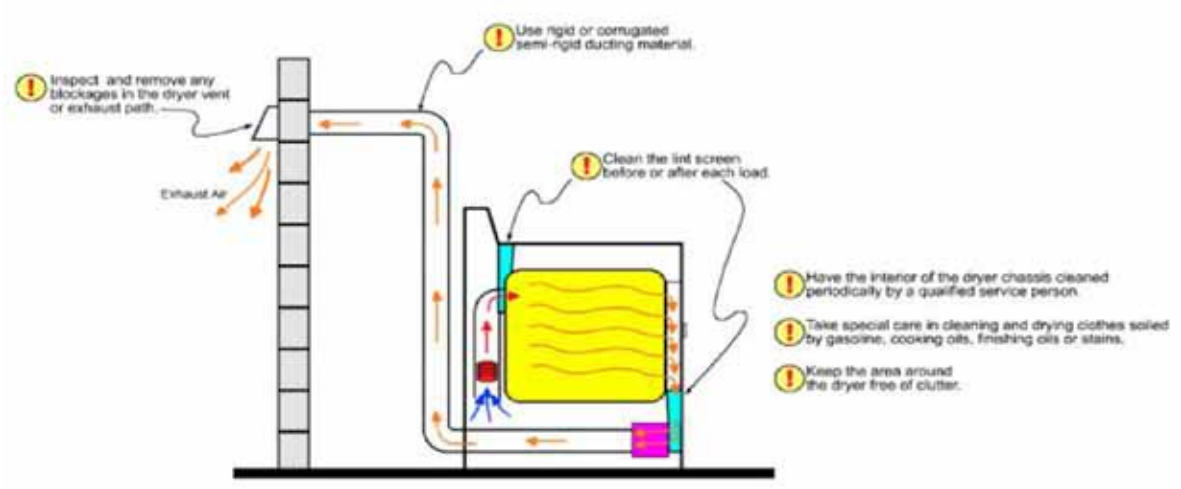
Electricity has incredible power, so it's no surprise when looking for the cause of a fire, electricity often gets the blame. Add the evidence of a big melted glob of copper wire and you've got a case! Or do you? Conventional wisdom has long held that visual examinations of melted copper on wires provided potential fire evidence. But a recent study, commissioned by no less than the National Institute of Justice has called this practice into question. And like all good stories, there are some pretty big players with deep, critical and vested interest in this work and ready to question the conclusions. Get a brief look at the history of electricity in fire investigation. See how we arrived where we are today, and what effect this landmark study will have on fire investigations and subrogation in the future.

Firefighter Strategy and Tactics: Why is someone cutting a hole in my roof?

When your insured suffers a fire loss, whether it's a single room or a complete structural loss, inevitably there are questions about damage to the structure and contents that appear totally unrelated to the locating and extinguishment of the fire. This interactive presentation will help insurance industry personnel to find the seat of the fire, get at hidden fires, extinguish fires and protect themselves from being overtaken by the fire. ☆

CPSC: Safety Alert

Overheated Clothes Dryers Can Cause Fires



Fires can occur when lint builds up in the dryer or in the exhaust duct. Lint can block the flow of air, cause excessive heat build-up, and result in a fire in some dryers.

To help prevent fires:

- **Clean the lint screen/filter before or after drying each load of clothes.** If clothing is still damp at the end of a typical drying cycle or drying requires longer times than normal, this may be a sign that the lint screen or the exhaust duct is blocked.

- **Clean the dryer vent and exhaust duct periodically.** Check the outside dryer vent while the dryer is operating to make sure exhaust air is escaping. If it is not, the vent or the exhaust duct may be blocked. To remove a blockage in the exhaust path, it may be necessary to disconnect the exhaust duct from the dryer.

- **Clean behind the dryer, where lint can build up.** Have a qualified service person clean the interior of the dryer chassis periodically to minimize the amount of lint accumulation. Keep the area around the dryer clean and free of clutter.

- **Replace plastic or foil, accordion-type ducting material with rigid or corrugated semi-rigid metal duct.** Most manufacturers specify the use of a rigid or corrugated semi-rigid metal duct, which provides maximum airflow. The flexible plastic or foil type duct can more easily trap lint and is more susceptible to kinks or crushing, which can greatly reduce the airflow.

- **Take special care when drying clothes that have been soiled with volatile chemicals such as gasoline, cooking oils, cleaning agents, finishing oils and stains.** If possible, wash the clothing more than once to minimize the amount of volatile chemicals on the clothes and, preferably, hang the clothes to dry. If using a dryer, use the lowest heat setting and a drying cycle that has a cool-down period at the end of the cycle. To prevent clothes from igniting after drying, do not leave the dried clothes in the dryer or piled in a laundry basket.

FCI: On The Fire Scene.

ISSUE INDEX

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SEAL'S 2013 iPAD MINI SWEEPSTAKES

EVERY PROJECT ENTERS YOU TO WIN!

Four (4) iPad Mini's will Be Given Away This Year!

Looking to get a iPad Mini? System Engineering And Laboratories (SEAL) is giving away four (4) iPad Minis! ***One lucky winner*** on the dates listed below will win!

Apple iPad mini, WiFi only, 16 Gig valued at $329.

May 24th, July 26th, Sept. 27th and Dec. 13th

SEAL's way of saying ***"Thank You"*** for letting us help you for the last 30 plus years!

NO PURCHASE IS NECESSARY TO ENTER OR WIN. SEAL'S Mini Sweepstakes is open to all individuals; To enter simply assign a project to System Engineering And Laboratories (SEAL) between **4-15-2013** and **12-13-2013, 5:00 PM.** The Winners will be contacted **on May 24th, July 26th, Sept. 27th and Dec. 13th**. All Winners will be contacted by e-mail or phone. Subject to all state and Federal laws. Void where prohibited by law and in certain states where sweepstakes registration is required. For complete Official Rules and to download the media form in pdf format, visit www.sealcorp.com/pages.php/sweepstakes.