Issue #54

ELECTRICAL CONDUCTIVITY

It's wintertime and you walk across a carpeted room to answer your front door. When you touch the doorknob, you receive a shock. This is caused by electrons jumping from you to the doorknob, which conducts electricity.

Most atoms are neutral, with protons (positive-charge particles) balanced with electrons (negative-charge particles) canceling each other out.

When this outer layer of an atom gets rubbed off, a slight positive charge is produced.
The item that rubs off the outer layer of the atom takes some of the extra electrons, giving it a slightly negative charge. Your feet have rubbed electrons off the carpet, leaving you with a slightly negative static charge and buildup of a static charge. Touching the doorknob discharges that static charge.

This built-up electric charge is static electricity. Static charge build-up is enhanced when the weather is dry and when humidity is low.

ELECTRICAL CONDUCTIVITY IN OUR INDUSTRY

The static discharge poses a serious threat when moving petroleum products through the distribution system. Hydrocarbons are poor conductors of electricity and static electricity may accumulate and take significant time to leak off to the ground. There have been cases where such accumulations discharged as high energy sparks that have caused fires or explosions under certain air/fuel vapor conditions. This is particularly true for modern jet fuels and ULSD because of their high purity, high pumping rates and the use of filtration capable of producing a high rate of charge separation and static buildup in the fuel. More information and actions required are described in greater detail in the Guide for Generation and Dissipation of Static Electricity in Petroleum Fuel Systems (ASTM D4865).

The standard field test for electrical conductivity has been the Test for Electrical Conductivity of Aviation and Distillate Fuels (D2624/IP 274). Although the method is intended for the measurement of conductivity with the fuel at rest in storage tanks, it can also be used in a laboratory. However, the method discourages the shipment of samples, because of container and storage effects. If needed, a more precise laboratory method for fuels of very low conductivities is the Test for Electrical Conductivity of Liquid Hydrocarbons by Precision Meter (ASTM D4308).

Electrostatic Ignition Requires ALL the Following:

1. Significant Charge Generation
2. Charge Accumulation
3. Electrostatic Discharge
4. Flammable Mixture

Electrostatic Ignition Considerations

- Complete elimination of flammable vapors impractical
- Electrostatic charging cannot be reasonably controlled
- Sparking is a function of charge accumulation
- Static dissipater additives prevent charge accumulation by increasing conductivity of fuel to ≥50 Pico siemens/meter (pS/m)

General Risk Factors

- Low conductivity Fuel
  - Risk greatly increases for conductivity <3 pS/m
- Switch-loading trucks or vessels
  - From high or intermediate vapor pressure products is high risk
- Operation Protocols
  - Fine filtration vastly increases risk
  - Truck bottom loading reduces injury, loss of life
- In 2006 the 'new' ULSD fuels increase risk
  - Shell determined ULSD 30x more hazardous than LSD

Risk Diminished by Using SDA

- Grounding and Bonding are still required
- Static Dissipator Additives (SDA) provide added protection
  - Historically very successful – when properly injected and mixed in fuel
- SDA use is Established Practice
  - ASTM D4865 "Standard Guide for Generation and Dissipation of Static Electricity in Petroleum Fuel Systems"
  - API "Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents", API Recommended Practice 2003, Sixth Edition, September 1998.

CONDUCTIVITY IMPROVER ADDITIVE IN AVIATION FUELS

Static charges can build up during movement of fuel and can lead to high-energy spark discharges. Static dissipator additives are designed to prevent this hazard by increasing the electrical conductivity of the fuel, which promotes a rapid relaxation of any static charge.

CONDUCTIVITY IMPROVER ADDITIVE IN ULTRA LOW SULFUR DIESEL

Conductivity of ULSD is very low at 1-2 pS/m. Static charge cannot dissipate quickly.
Conductivity improvers are needed to replace lost natural polar components. Besides relaxation time, it's the only way to effectively increase conductivity.

STATIC DISSIPATOR ADDITIVE

This additive is added in such low concentrations that it is extremely difficult to detect by any standard analytical procedure. Therefore, it is controlled by measuring the resultant electrical conductivity of the fuel. Meters described in ASTM D2624/IP 264 are commonly used for this purpose. A new test method has been developed to detect SDA by HPLC and has been published as IP 568.

AMSPEC ADDITIVES

We can provide SDA and full-service additive treatment solutions to meet the challenging, opportunity and routine specifications for the trading, terminal, petrochemical, oil field and refining markets.

We have a full line of additives that can be applied via inline treatment at a terminal, plant or refinery; during tank transfers; onboard a vessel at anchorage or lay berth; into a railcar, barge or tank.

Our AmSpec additives team can provide the desired technical support and turnkey rapid response treatments. We are available 24/7 to take your call or email.

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