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Triodyne Inc.

Consultants in Safety Philosophy and Technology

5950 West Touhy Avenue Niles, IL 60714-4610 (847) 677-4730

FAX: (847) 647-2047

e-mail: infoserv@triodyne.com

VEHICLE SAFETY

The Runaway Diesel – External Fuel Ingestion

by Christopher W. Ferrone[1] and Charles Sinkovits[2]

ABSTRACT

When a diesel engine is exposed to a combustible airborne environment it has a propensity to become a "runaway."

DISCUSSION

A runaway can be described as an engine running out of control on an external fuel source, such as gasoline vapors or mist. Specifically, the engine draws in the surrounding combustible mixture and uses this as fuel, increasing the engine's RPMs. This situation is classically unstable and uncontrollable. The engine draws in the vapor through the air cleaner into the aspiration system, usually a turbocharger, and into the engine (see Fig 1). At this point the engine only has control over the onboard diesel fuel supply (see Fig. 2) via the engine's governor or the engine's microprocessor. As the engine's RPMs increase due to the vapor ingestion, the governor attempts to limit the onboard fuel supply to the engine. Normally this would reduce the RPMs and keep the engine under control. However, the engine continues to increase the RPMs by drawing in more vapor or mist as fuel.

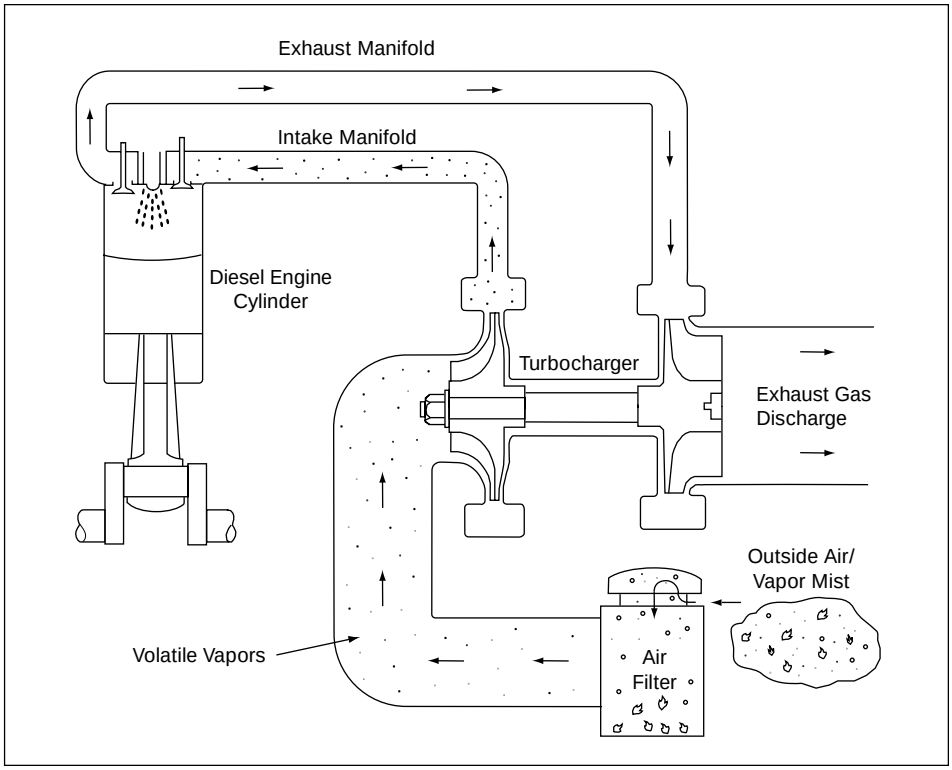

Fig. 1 Typical Air Intake System – 4 Cycle Diesel

[1] Senior Mechanical Engineer, Triodyne Inc., Niles, IL.

[2] Senior Vehicle Service Specialist, Triodyne Inc., Niles, IL.

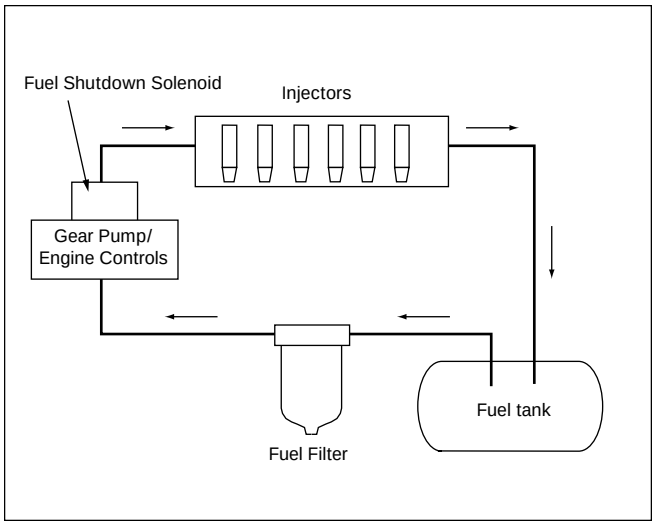

Fig. 2 Typical Diesel Engine Fuel System Schematic

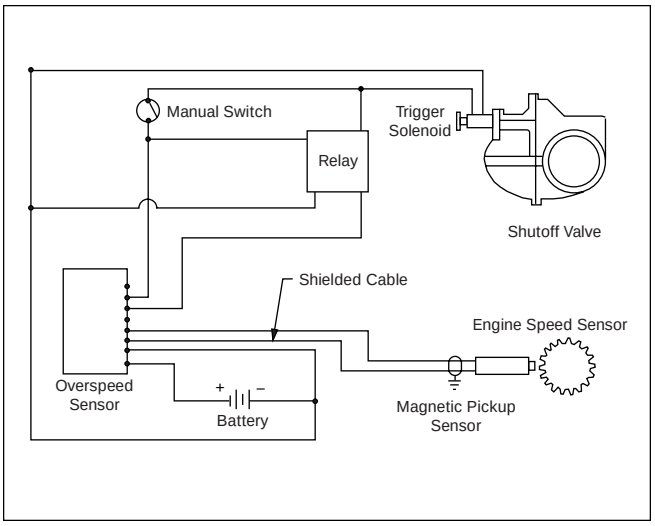

Fig. 3 Schematic of Adjustable Automatic System

THE PROBLEM

Once enough vapor has collected in the intake system, the column of volatile vapors can explode. This is by definition the classic "backfire," combustion within the intake system. This explosion can ignite the surrounding area's remaining vapor or mist creating a fire.

Examples of external fuel sources are numerous. Some are loading docks with leaking forklift LPG fuel tanks, chemical plants with various airborne combustibles, and gas station vapors.

Simply trying to shut off the engine by pushing the stop button or removing the ignition key just won't work. Ignition controls only manage the engine's governing system. Therefore with an external fuel source present, key removal is often a tragic waste of valuable escape time.

THE SOLUTION

With all varieties of diesel engines, the common denominator is combustion air. Diesels have a multitude of fuel control schemes but utilize air the same way. Therefore controlling combustion air is the key to absolute engine control.

The first and most direct method for eliminating a runaway is to simply shut off the engine at the loading/ unloading destination. If this is not possible, due to a need for running the engine, an air intake shut-off valve can be installed. These valves come in two varieties: passive and active. The passive system is automatic and sensitive to engine RPM (see Fig. 3). If the engine exceeds a preset RPM it will shut off the engine by eliminating combustion air. Active systems are usually controlled by the operator by a pull cable or a push button. When activated, a gate swings shut and positively blocks the combustion air path between the air cleaner and the turbocharger resulting in total shut down of the engine (see Fig. 4).

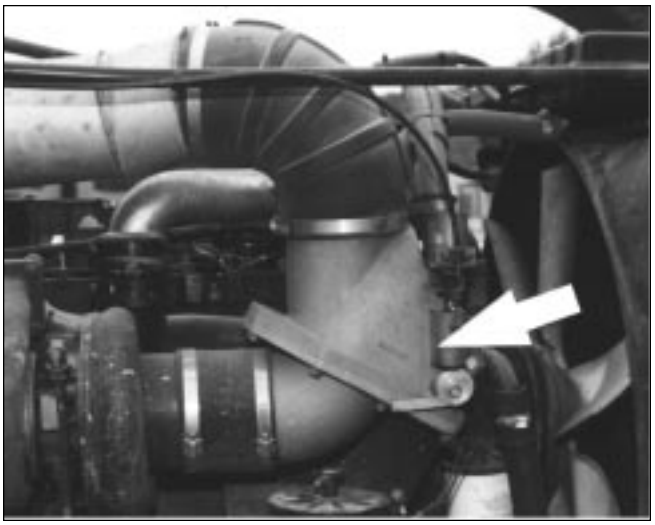

Fig. 4 Installed Air Intake Shutoff Valve

SUMMARY

When a diesel engine is exposed to an environment where there is an external fuel source, it is recommended that it be equipped with an air intake shut-off valve. This will ensure the operator of total control of the engine and prevent any potential for engine runaway.

It should be noted that it is always better to avoid the problem rather than solve the problem. The operator should always shut off the engine when it is not in use.