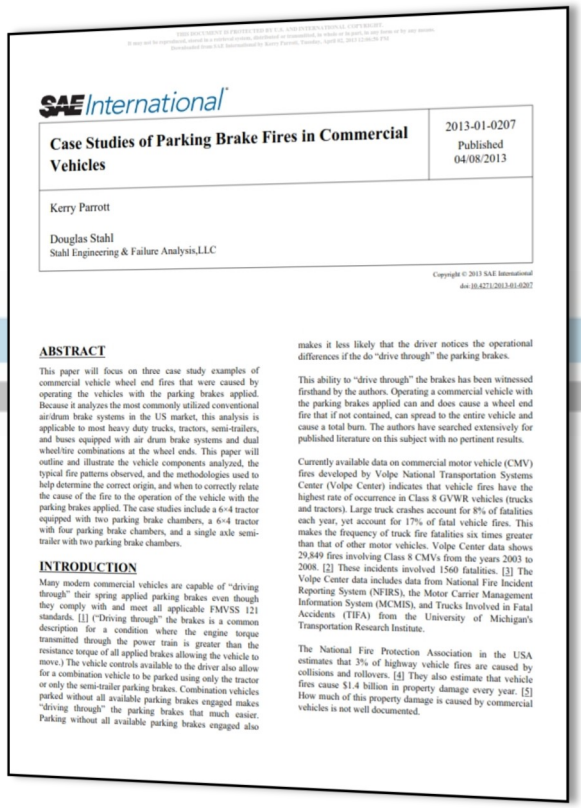
StahlEngineering
& FAILURE ANALYSIS, LLC

PUBLICATION:

Case Studies of Parking Brake Fires in Commercial Vehicles

Kerry D. Parrott, BSME, CFI, CFEI/CVFI
Douglas R. Stahl, PE, CFEI/CVFI

PUBLISHED IN:



SAE International

Case Studies of Parking Brake Fires in Commercial Vehicles

2013-01-0207
Published
04/08/2013

Kerry Parrott

Douglas Stahl
Stahl Engineering & Failure Analysis,LLC

ABSTRACT

This paper will focus on three case study examples of commercial vehicle wheel end fires that were caused by operating the vehicles with the parking brakes applied. Because it analyzes the most commonly utilized conventional air/drum brake systems in the US market, this analysis is applicable to most heavy duty trucks, tractors, semi-trailers, and buses equipped with air drum brake systems and dual wheel/tire combinations at the wheel ends. This paper will outline and illustrate the vehicle components analyzed, the typical fire patterns observed, and the methodologies used to help determine the correct origin, and when to correctly relate the cause of the fire to the operation of the vehicle with the parking brakes applied. The case studies include a 6×4 tractor equipped with two parking brake chambers, a 6×4 tractor with four parking brake chambers, and a single axle semi-trailer with two parking brake chambers.

INTRODUCTION

Many modern commercial vehicles are capable of "driving through" their spring applied parking brakes even though they comply with and meet all applicable FMVSS 121 standards. [1] ("Driving through" the brakes is a common description for a condition where the engine torque transmitted through the power train is greater than the resistance torque of all applied brakes allowing the vehicle to move.) The vehicle controls available to the driver also allow for a combination vehicle to be parked using only the tractor or only the semi-trailer parking brakes. Combination vehicles parked without all available parking brakes engaged makes "driving through" the parking brakes that much easier. Parking without all available parking brakes engaged also makes it less likely that the driver notices the operational differences if the do "drive through" the parking brakes.

This ability to "drive through" the brakes has been witnessed firsthand by the authors. Operating a commercial vehicle with the parking brakes applied can and does cause a wheel end fire that if not contained, can spread to the entire vehicle and cause a total burn. The authors have searched extensively for published literature on this subject with no pertinent results.

Currently available data on commercial motor vehicle (CMV) fires developed by Volpe National Transportation Systems Center (Volpe Center) indicates that vehicle fires have the highest rate of occurrence in Class 8 GVWR vehicles (trucks and tractors). Large truck crashes account for 8% of fatalities each year, yet account for 17% of fatal vehicle fires. This makes the frequency of truck fire fatalities six times greater than that of other motor vehicles. Volpe Center data shows 29,849 fires involving Class 8 CMVs from the years 2003 to 2008. [2] These incidents involved 1560 fatalities. [3] The Volpe Center data includes data from National Fire Incident Reporting System (NFIRS), the Motor Carrier Management Information System (MCMIS), and Trucks Involved in Fatal Accidents (TIFA) from the University of Michigan's Transportation Research Institute.

The National Fire Protection Association in the USA estimates that 3% of highway vehicle fires are caused by collisions and rollovers. [4] They also estimate that vehicle fires cause $1.4 billion in property damage every year. [5] How much of this property damage is caused by commercial vehicles is not well documented.

To obtain this paper, find related information, or talk with the authors:

Go to: www.Stahl-Engineering.com

SYNOPSIS:

This paper examines three case studies of commercial vehicle wheel end fires caused by operating vehicles with the parking brakes applied. It analyzes the most commonly utilized conventional air/drum brake systems in the U.S. market found on most heavy duty trucks, tractors, semi-trailers, and buses equipped with dual wheel/tire combinations at the wheel ends. The paper outlines and illustrates the vehicle components analyzed, typical fire patterns observed, methodologies used to help determine the correct fire origin, and when to correctly relate the cause of the fire to the operation of the vehicle with the parking brakes applied.

The case studies include a 6×4 tractor with two parking brake chambers, a 6x4 tractor with four parking brake chambers, and a single axle semi-trailer with two parking brake chambers.

The paper illustrates the process used to determine the area of origin for each example, and then discusses the root cause determination for all three. In each case, the evidence shows that the vehicles were operated with the parking brakes applied. The study emphasizes the documentation and summarization of the most common burn patterns and evidence created in fires caused by spring applied parking brake systems.