The Phenomenon of Loading Dock Seal Fires: How and Why They Occur and the Development of the Technology to Prevent Them

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Background

The Frommelt® Insulator™ Dock Sealing System with fire-resistant Firefighter™ components began life as a Frommelt research and development project undertaken in 1999. The goal was originallay to develop a dock seal to specifically address troublesome issues prevalent in the food and beverage industry. These issues included burned head pads (determined to be caused from the heat of standard over-the-road trailer marker lights), high traffic and abusive conditions affecting seal wear, and the need for a reliable, high efficiency seal for cooler and freezer docks.

As technical and marketing development progressed it became apparent that these issues were critical to a much broader customer base than a single, narrowly defined industry. Burned head pads or head pads damaged with burn holes can be found on virtually any dock at which truck/trailers may stay parked with the engine running for as little as 20 to 30 minutes. Also, as all segments of business strive to improve productivity, traffic at any dock can be quite heavy and abusive. Furthermore, as energy costs continue to rise, there are really no users who can afford to install "inefficient" seals.

Thus, the Insulator system was born, designed to address these critical issues at the loading dock, across the entire spectrum of dock equipment users. The Insulator system features proprietary design elements that give it outstanding durability and sealing efficiency, as well as protection from fires caused by the heat of trailer marker lights. After initial release into the general market, however, the fire-resistant Firefighter header seal component drew particular customer interest, as the incidence of burned head pads was being noticed with dramatic frequency.

Solving the Mystery of the Burned Dock Seal

The fact that ordinary trailer marker lights could cause fires in dock seals was not immediately accepted, even by Frommelt's own engineering team, who examined burned dock seals looking for answers to the question of how the fires started. It soon became apparent that trailer marker lights were, in fact, the source of the danger.

Since 1968, The National Highway Traffic Safety Administration (NHTSA) has required all van style trailers 80 inches wide or wider to have a minimum of (2) rear clearance lamps, and exactly (3) rear identification (marker) lamps mounted on the upper header. At the time this requirement was issued, however, NHTSA left the decision for use of the marker lamps up to the trailer manufacturer's discretion due to the fact that available marker lamps were not of the size or type that could be easily mounted on the upper header of the trailers. Most trailer manufacturers, therefore, did not install the lamps. As lights were made smaller, however, and more easily installed on the narrow headers, NHTSA issued an Interpretive Ruling on April 5, 1999, mandating the use of the marker lamps on all trailers. The resulting enforcement of the original rule corresponds with a dramatic rise in incidence of reported burn damage to head pads and dock seal fires.

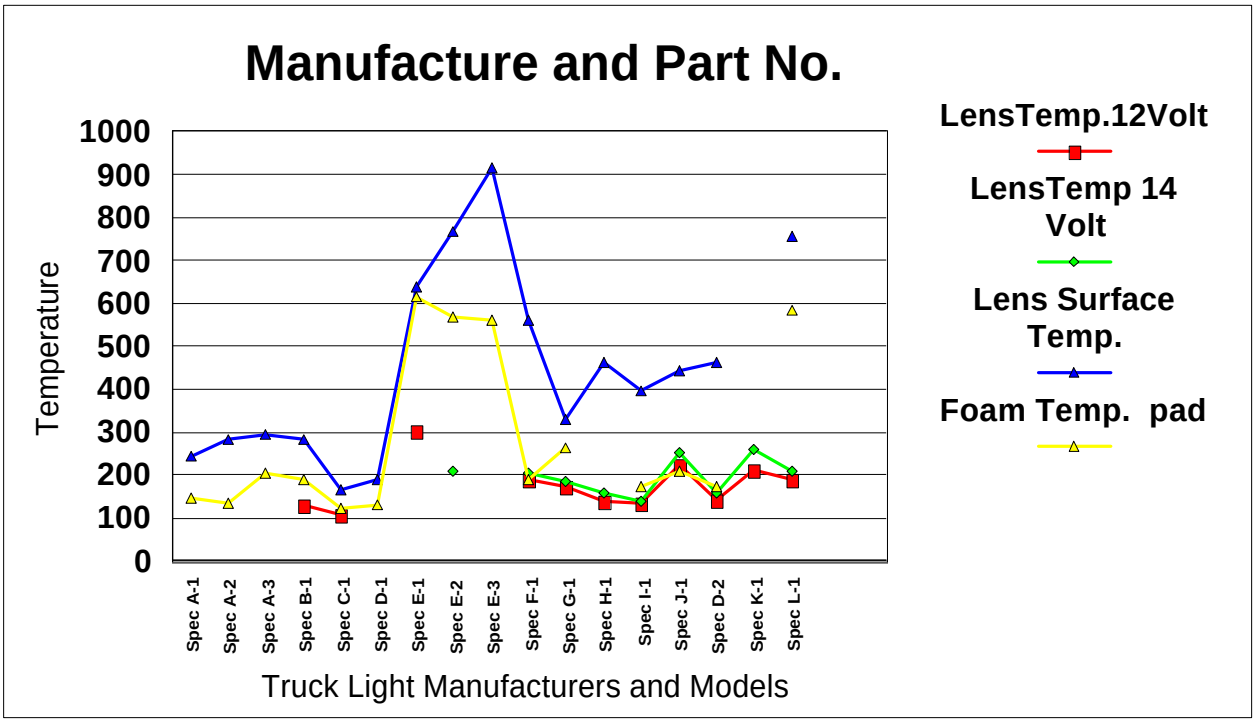
In Frommelt's investigation of these fires, the evidence that trailer marker lights were causing burn holes and fire damage to dock seal head pads was clear, but how they caused the burn damage was initially a mystery. Frommelt's test program eventually identified and verified the mechanism by which low wattage bulbs in trailer marker lights create the high temperatures needed to melt or burn vinyl, hypalon, and polyurethane foam -- the components of common, compression-style foam dock seals.

It was initially assumed that only a damaged trailer marker light, in which the bulb filament could actually contact the seal materials, could cause the burning. This, however, proved not to be the case. As it turns out, the burning actually occurs from the heat output of the individual marker lights which gradually builds to a high temperature in a very concentrated area due to the insulating effect of being compressed into the foam pad over a period of time. No external source of ignition, such as an exposed bulb filament, is required.

Once the burning has begun, polyurethane foam can combust or "auto-ignite" at temperatures exceeding 800 ºF when exposed to a large quantity of oxygen, such as the air being quickly drawn in to the compressible, open cell foam when a parked trailer leaves the dock. This explains why many dock seal fires erupt quickly as the trailer departs. This same "influx of oxygen" phenomenon can occur to some degree while the trailer is still parked and moving vertically as it is being loaded or unloaded.

Additionally, our research with truck industry trade groups indicated that it is very common for trucks to be retrofitted with secondary alternators. These provide the additional power required by the many appliances (TVs, microwaves, VCRs, stereos, etc.) that are often installed in sleeper cabs. These two alternator systems operate at approximately 14 volt output under most conditions.

Testing under these conditions proved to us that undamaged trailer marker lights can in fact cause the temperature at the foam/fabric interface to reach in excess of 900º F. Furthermore, the testing showed that, under these conditions, when the foam compression was released and the pores filled with air, the foam could auto-ignite, causing a smoldering fire initially, and developing to actual flame if not extinguished.



The Solution

Although there are many fireproof materials commercially available for a wide variety of industrial uses, none possesses the combination of strength, abrasion resistance and heat resistance that would allow a simple substitution of fabric on a dock seal. In other words, there are no commercially available products that could be used effectively on a dock seal that would provide protection against the heat of trailer marker lights and be capable of providing necessary durability and sealing efficiency attributes. Our approach to gaining fire resistance, however, allowed us to use fabrics designed for high wear reliability, and still mitigate the issue of temperature buildup from trailer marker lights.

We chose to design the Firefighter head pad so as to dissipate the heat generated before it can build to dangerously high temperature levels. This patented approach is accomplished by the incorporation of three layers of reinforced heavy duty metal foil, sandwiched between inner and outer layers of vinyl compound coated fabrics, all covering a fire-retardant polyurethane foam block. The triple layer foil acts as a heat "sink," readily absorbing the heat generated by the marker light, and dissipating it across the entire surface of the pad, instead of allowing excessive heat build-up in a small, concentrated area.

Our testing showed that, under the same test conditions as above, when the Firefighter head pad was exposed to hot trailer marker lights, the temperature at the pad surface remained below 440º F, versus the previous 900º F. This is well below the temperature at which the foam can auto-ignite.

Warning: Avoid False Sense of Security with Fire Retardant Materials

All dock seal manufacturers offer fire retardant fabric and foam as options. These materials, however, do not protect the seal components themselves from burn damage, but rather are designed to "self extinguish" after igniting, to prevent the spread of fire. By definition, fire retardant materials must begin burning for the "retardancy" nature to take effect. Significant dock seal damage can still occur even if fire retardant materials are used.

Frommelt Firefighter technology, on the other hand, dissipates the heat from trailer marker lights, keeping temperatures low enough to prevent burning of the foam and fabric components, thus preventing damage to the dock seal, as well as protecting against the spread of fire.