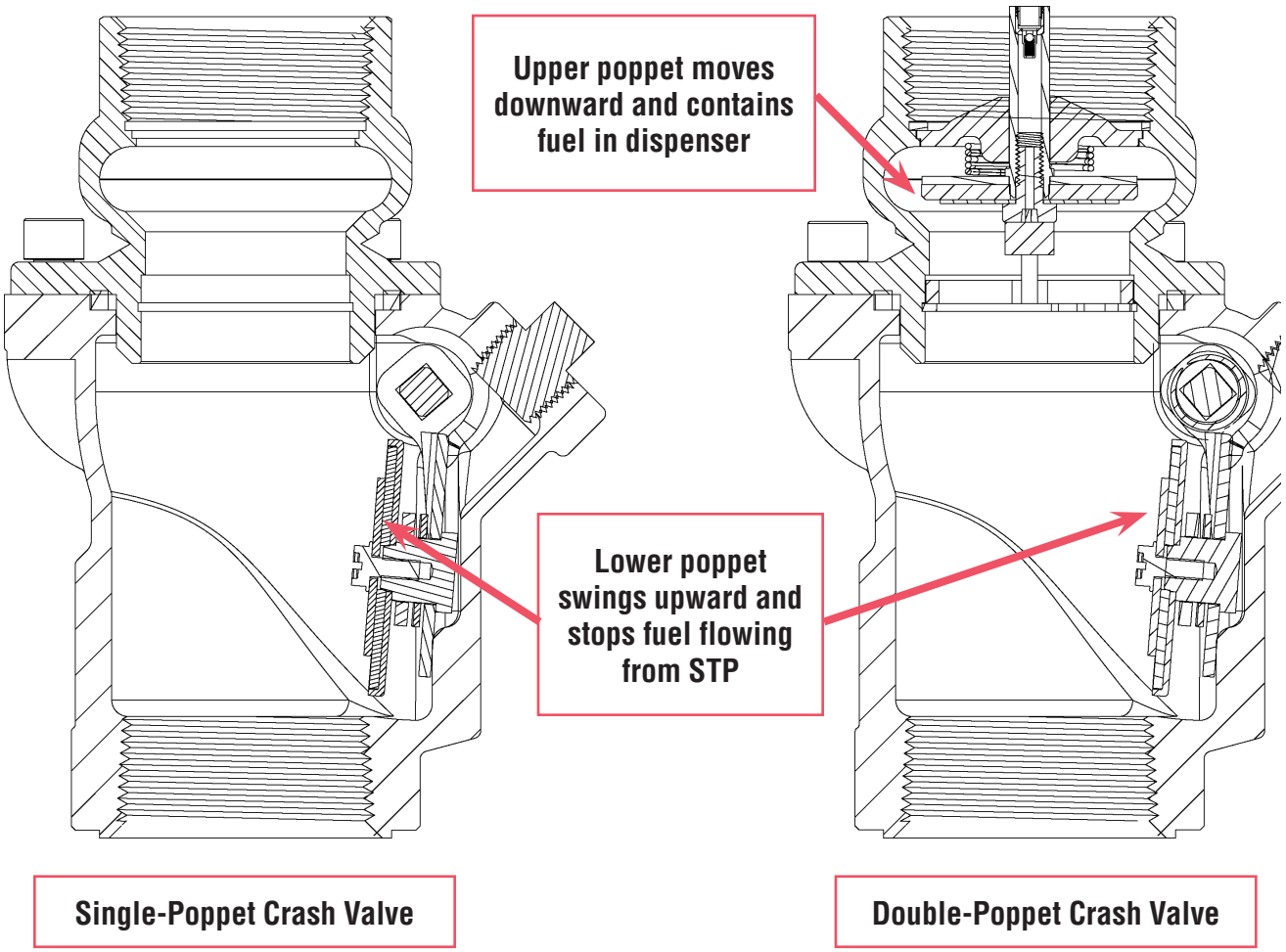
Tank-nically Speaking

by Marcel Moreau

*Marcel Moreau is a nationally recognized petroleum storage specialist whose column, **Tank-nically Speaking**, is a regular feature of* LUSTLine. *As always, we welcome your comments and questions. If there are technical issues that you would like to have Marcel discuss, let him know at* **marcel.moreau@juno.com.**

Are Two Poppets Better Than One?



Note: Both valves are shown in the open position.

Graphic courtesy of OPW

Crash valves installed at the base of dispensers are supposed to stop the flow of fuel from the submersible pump when a vehicle hits the dispenser. Yet…

- **In New York State** this past July (2014), a driver, suffering from a medical condition, plowed into a dispenser at a high rate of speed. A substantial fire erupted immediately and was beginning to engulf the passenger compartment of the car when an off duty policeman, who was filling up nearby, bravely pulled the unconscious driver to safety (and then ran back to retrieve the ammunition in the trunk of his car before his vehicle was engulfed in flames.) But for the courage of the bystander, the driver would have been toast. (To view surveillance camera footage of this incident, go to: *https://www.youtube.com/watcH?V=V0HULVEK6I0&LIST=PLD185CA6C7ACA4E45&INDEX=51*)
- **In Washington State** (2012), a driver maneuvering at a gas station backed into a dispenser and knocked it over. Flames erupted as the driver drove away. The fire continued to burn for some time. (To view surveillance camera footage of this accident go to: *https://www.youtube.com/watch?v*

=gL360th3mFI&list=PLD185CA6C7ACA4E45&index=40)

- **In Maine** (2004), the inebriated driver of a pickup truck crashed into a dispenser, which immediately erupted into flames. The driver backed up and drove away. A couple fueling their car at a nearby dispenser ran for safety. An automatic fire suppression system eventually put the fire out, but not before the flexible piping in the sump beneath the dispenser had been substantially damaged by the heat. If an alert operator had not activated the emergency stop switch to shut down the submersible pumps, the fire could have been catastrophic. (To watch the video go to: *https://www.youtube.com/watch?v=zgTBtwoo1io&index=45&list=PLD185CA6C7ACA4E45*)

In each of these incidents, the single-poppet crash valves functioned as designed. Flow from the submersible pump was stopped and no geysers of gasoline erupted from the dispenser islands. But there were still serious fires that could have resulted in serious injuries or death. How come?

Alas, the Single-Poppet Crash Valve

When a single-poppet crash valve shears, the valve mechanism in the bottom half of the crash valve closes and stops the flow of fuel from the submersible pump. But the fuel already in the dispenser can flow out into the environment because the top part of the crash valve contains no valve mechanism.

How much fuel can be released? It depends on the dispenser design, but for dispensers with three products on each side, there could be as many as six filters, six meters, six hoses, plus tens of feet of tubing connecting all these components, potentially releasing several gallons of gasoline. When the vapor from the spilled gasoline encounters broken electrical wires, sparks from scraping metal, or hot components of the vehicle engine, the likelihood of a fire is high. The result? Serious fires that cause significant damage and sometimes kill or severely injure people.

Is There a Better Way?

A quarter century ago, at the request of oil companies seeking to limit the damage resulting from vehicle/dispenser crashes, petroleum equipment manufacturers introduced the double-poppet crash valve. The bottom half of the valve is identical to the single-poppet version of the crash valve. The difference is in the upper half. In the double-poppet design, the upper portion of the crash valve contains another valve mechanism that remains open as long as the crash valve remains intact. When the crash valve activates in an accident, the upper poppet closes and the gasoline in the dispenser components is contained.

Using double-poppet crash valves seems like a no-brainer in terms of safety. The additional cost seems easily justifiable as well, because the cost of repairing extensive fire damage from even one event will pay for the extra cost of a lot of double-poppet crash valves. Despite the apparent advantages, fire codes and industry recommended practices (with one exception) are silent on the advantages of double-poppet crash valves:

- American Petroleum Institute Recommended Practice 1615, *Installation of Petroleum Storage Systems*, states, "Double poppet or secondarily contained double poppet impact (shear) valves should be considered for additional safety." (API 1615, sixth edition, April 2011, p. 41).
- PEI RP 100, *Recommended Practices for Installation of Underground Liquid Storage Systems*, is silent on the matter. (PEI RP 100-11, p. 25).
- The *International Fire Code* also does not indicate a preference for either single- or double-poppet crash valves (IFC 2009, Section 2206.7.4).
- NFPA 30A, *Code for Motor Fuel Dispensing Facilities and Repair Garages* (the code that has required the installation of crash valves since 1966) is also silent as to which type of crash valve to use (NFPA 30A, 2012 edition, Section 6.3.9).

The NFPA *Flammable and Combustible Liquids Code Handbook*, which provides background information and additional commentary concerning the code requirements, explains that the NFPA Technical Committee does not recommend double-poppet crash valves because some members of the Committee believe that these valves pose a hazard to emergency response personnel. According to the Handbook, the concern is that if there is a fire surrounding the dispenser, the fuel trapped inside the dispenser could "forcefully rupture," endangering emergency response personnel who might be working to control the fire (*Flammable and Combustible Liquids Code Handbook, 2012 Edition*, p. 515). This has been the position of the NFPA Technical Committee since at least the 1996 edition of the NFPA Handbook (*Flammable and Combustible Liquids Code Handbook, 1996 Edition*, p. 404).

But is the scenario envisioned by the NFPA Technical Committee realistic? In other words, do dispensers equipped with double-poppet crash valves commonly blow up when they are hit and a fire results? Because a large number of double-poppet crash valves have been in service for many years now, we should be able to answer this question. What has been the experience of people who have used double-poppet crash valves as standard equipment for many years? To help answer this question, I sought the help of my colleague Ben Thomas of UST Training, who has a vast network of contacts in the UST world. Here's what we found.

- Larry Gregory, who was responsible for Exxon's gas stations on a global scale until a few years ago, reports that he specified double-poppet valves immediately after they were introduced. He is a firm believer in their ability to reduce fires when dispensers are hit and reports that he has never heard of an incident where a dispenser equipped with a double-poppet crash valve blew up.
- An east coast petroleum marketer with well over a thousand stations has also equipped his facilities with double-poppet crash valves for many years. He reports that on average he sees

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a dispenser accident about once a week, but despite hundreds of dispenser impacts in recent years, he has not had any fires that resulted from these incidents.

- Another east coast petroleum marketer with several hundred gas stations uses double-poppet crash valves exclusively and has thousands in service. These stations typically experience one or two dispenser accidents a month, but in the past 18 years, there have only been four fires. In one incident that resulted in a fire, the fire chief's report concluded that the fuel that ignited came from the vehicle and not the dispenser. This company has never experienced a dispenser explosion.

John Albert, who administers Missouri's tank program, reports that dispensers in Missouri with non-metallic product piping must either have double-poppet crash valves or fire extinguishers installed in a sump beneath the dispenser. The rules reflect John's experience that double-poppet crash valves greatly limit the potential for fires when dispensers are hit. "We've had many dispensers get hit over the past 25 years, but very few fires," says John. He is aware of the differing points of view among fire officials but has never had a dispenser explode because of a double-poppet crash valve. "My experience is that the soft seals in the meter and filter are the first things to fail in a fire scenario. This results in a slow release of product, but no explosion."

OPW is a major manufacturer of both single- and double-poppet crash valves for use not only in North America but also throughout the world. Glenn Eckart of OPW told us that the OPW double-poppet shear valve has incorporated a pressure relief feature since it was first introduced in the late 1980s. Since they were first manufactured in the late 1980s, no one at OPW can recall ever receiving a report of a dispenser equipped with a double-poppet crash valve exploding.

These anecdotal reports from a variety of knowledgeable people clearly point to the advantages of double-poppet crash valves and provide no support for the NFPA position that these valves pose a threat to emergency response personnel. We e-mailed Robert Benedetti, Principal Flammable Liquids Engineer at NFPA, to ask whether they knew of any incidents where the "forceful rupture" of a dispenser equipped with a double-poppet crash valve had actually occurred.

Mr. Benedetti replied, "This issue of single- versus double-poppet valves came up several editions of the code ago. At the time, the Technical Committee discussed this issue with respect to fire suppression activities. As I recall, the fire service representatives on the Technical Committee were leery of a fire beneath a dispenser whose components contained liquid that was 'locked in.' This issue has never been brought up since."

If experience shows otherwise, then all that needs to be done is for someone to submit a proposal to amend NFPA 30A to allow the double-poppet design.

Bottom Line?

You guessed it. We believe that double-poppet crash valves have clear safety advantages over the single-poppet versions and their use should be at least a recommended practice if not an outright requirement. While some well-informed petroleum marketers are already using double-poppet crash valves, many marketers who are not aware of the added safety provided by double-poppet valves continue to specify the single-poppet versions. This substantially increases the risk that fires will result when dispensers are hit and people will get seriously hurt. Our goal in writing this article is to educate the UST community about this issue and to encourage UST owners to seriously consider double-poppet shear valves as a means to limiting liability, limiting damage, and ultimately, saving lives.

Oh, and we do plan to submit a comment to amend the next edition of NFPA 30A. ■

If you have a shear valve story you'd like to share showing how single- or double-poppet shear valves did or did not save the day, we'd love

Crash Valve Musts

While crash valves are the wallflowers of the UST world, waiting patiently for their turn to save the day, they must not be ignored. Crash valves are critical pieces of UST safety equipment that must be properly installed and maintained if they are to do their job. Here are some basics:

- They must be rigidly anchored to the island and properly fastened to the dispenser
- They must be installed at the proper height relative to the dispenser island
- They should be tested for operation annually
- Fittings tightness testers installed in the test plug opening of the valves must NOT be left in place when the tightness test is completed.

You Say Crash, I Say Shear

The crash valves in this article are called different names around the country. What do *YOU* call them?

- ☑ Crash valve
- ☑ Shear valve
- ☑ Fire valve
- ☑ Impact valve
- ☑ Emergency shutoff valve
- ☑ Earthquake valve