OTD 5.11.s

Breakaway Fitting (OPW HaloValve)

Summary of Test Results

Report Issued:
August 24, 2018

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Breakaway Fitting

Meter Set Assemblies (MSA) and other above ground gas facilities are too often damaged by various outside forces, namely vehicular damage. Vehicular impacts with meter sets and other aboveground gas piping systems are not rare occurrences. These incidents unfortunately occur on a regular basis. According to U.S. Department of Transportation Data on Serious Pipeline Incidents (2005-2016), the two primary factors that contributed to U.S. gas distribution incidents is “excavation damage” and “other outside force damage (e.g. vehicular impact)”. Distribution Integrity Management (DIM) programs require utilities to identify the threats that may affect the safety and performance of the distribution facilities and take action to minimize these threats. One of the most common threats to aboveground piping is vehicular and other outside force damage to meter sets.

The breakaway fitting is designed to do just that, minimize the threat of incident if the meter set or other aboveground distribution piping is impacted by an outside force. Common outside force impacts include vehicular and other motorized equipment impacts and also falling snow and ice from building roofs.

The breakaway fitting will reduce the risk of gas leaks, fire, explosion, property damage and possible injury caused by outside forces impacting and damaging the MSA. This new product development will result in increased safety for home-owners and will enhance the overall safety for the delivery of natural gas.

This document summarizes the various testing that was performed on the breakaway fitting which was developed for natural gas meter sets and other aboveground piping.

Figure 1. Meter set before and after the installation of the breakaway fitting

Flow Testing

GTI performed flow testing on the newly designed breakaway fitting and found that the new design not only incorporates external enhancements and various configurations, but also increases the gas flow through the fitting and reduces the pressure drop. Results of the flow testing are shown below in **Figure 2** &**Figure** 3.

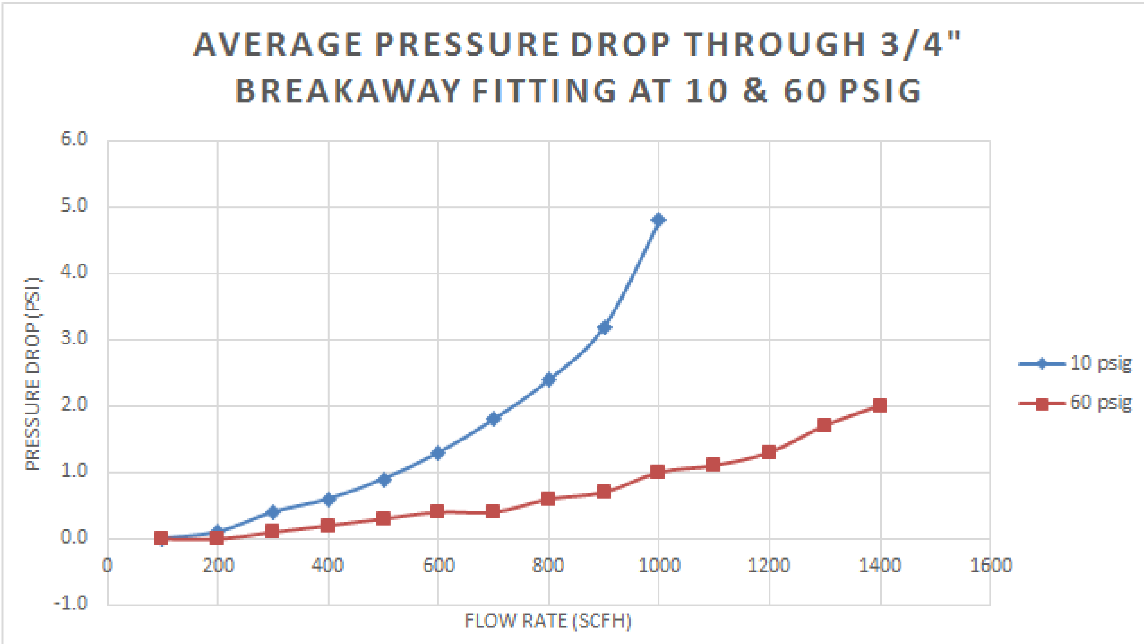

Figure 2: Flow Testing Results through Breakaway Fitting at 10 & 60 psig

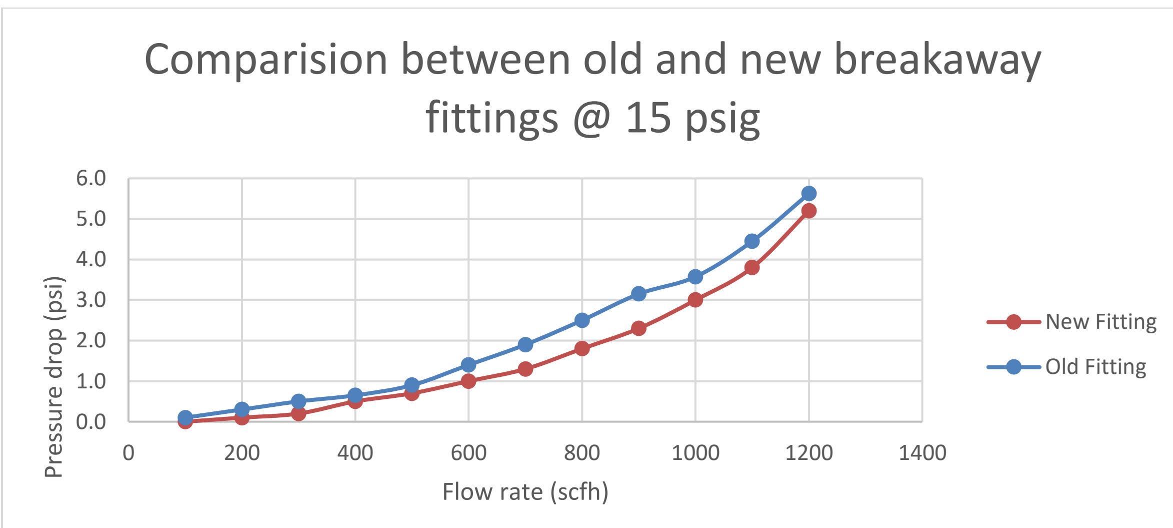

Figure 3: Comparison of Flow Testing Results Between Old and New Generation Breakaway Fittings at 15 psig

Simulated Crash – Pendulum Impact Testing

Tests were conducted with a suspended weight with a potential energy of approximately 450 J being released and impacting the meter set from 3 different directions (parallel to the wall – hitting the regulator first, parallel to the wall – hitting the meter first, perpendicular to the wall – head on collision). The two most common results were to have a successful breakaway where the path of air was supplied to the breakaway and the breakaway broke in half; or to have the threads of the pipe nipple going into the street valve break, causing the air to not reach the breakaway fitting. The impacts were categorized into those two results and an "other" category. Those results are shown below in **Figure 4**.

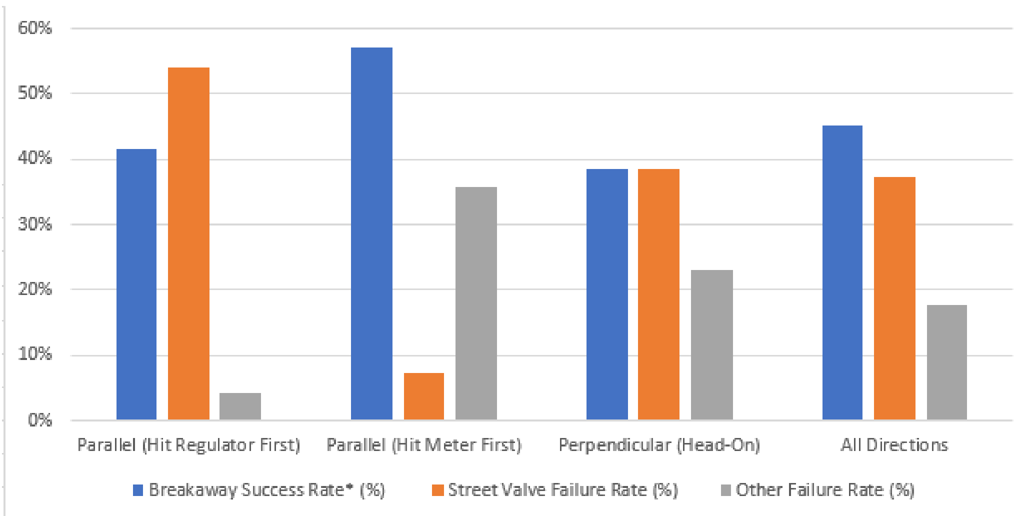

Figure 4: Breakaway Success Rate Based on Impact Direction

It was noted that when impacted by the suspended weight in a direction parallel to the wall while hitting the regulator first, that the direction of the regulator had a slight affect on whether the breakaway was successful or if there was a street valve failure. The effect of the direction that the regulator is facing depending on the impact directions can be seen in **Figure 5**.

Figure 5: Effect of Regulator Direction Based on Impact Direction

The design of the meter set also affected the success rate of the breakaway fitting. The effect of a connector bar between the inlet and outlet of the meter is shown in **Figure 6**. And the effect of the shape of the pre-fab is shown in **Figure 7.**

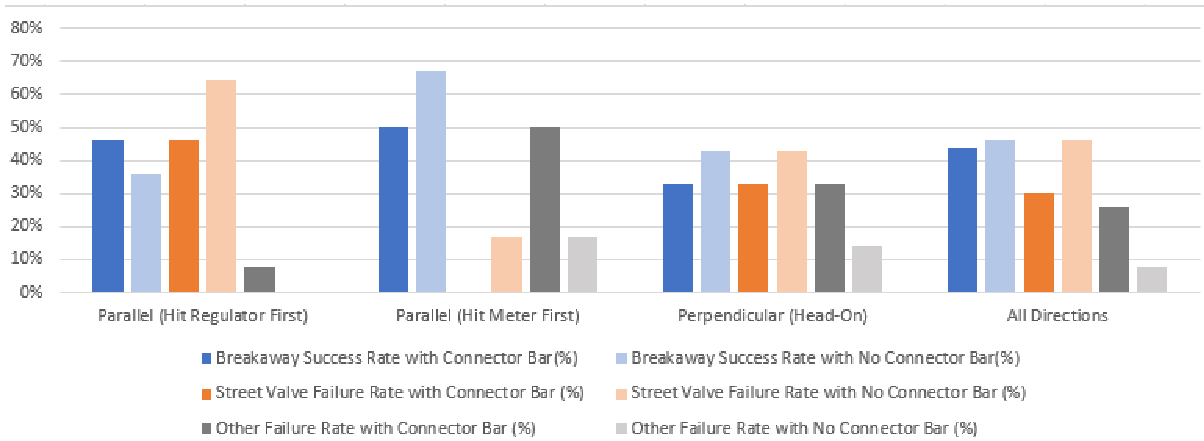

Figure 6: Effect of Connector Bar Based on Impact Direction

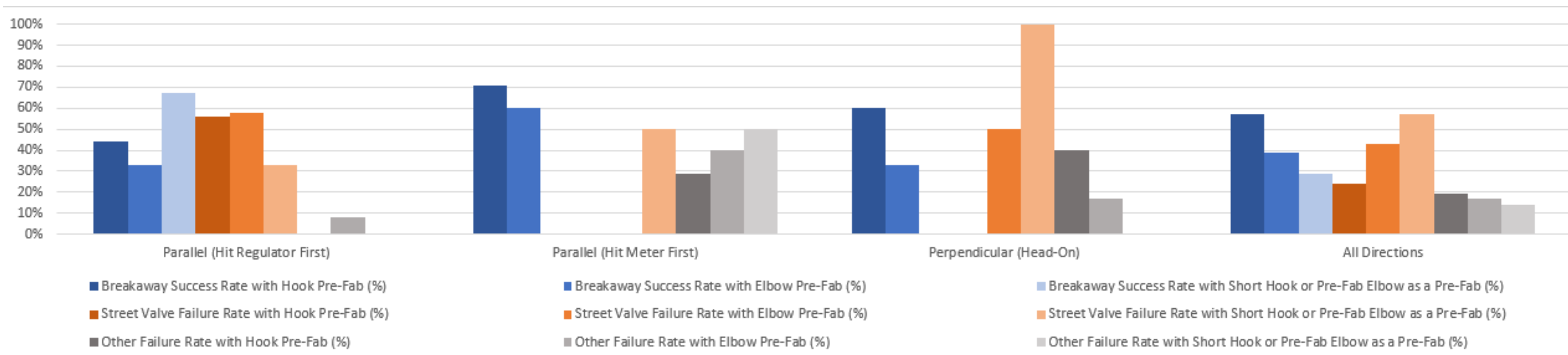

Figure 7: Effect of Pre-Fab Configuration Based on Impact Direction

GTI replaced the Sch 40 riser with a Sch 80 riser in an attempt to reduce the amount of Street Valve Failures present. One test was performed with the impact in a direction parallel to the wall hitting the regulator first, with the regulator in facing the wall; as this was the most common Street Valve Failure (shown in **Figure 5**). Only one test was performed, but as shown in **Figure 8**, for that test the threads going into the street valve stayed intact and the breakaway was successful.

During the development of the breakaway fitting, drop impact testing was conducted on schedule 40 and schedule 80 risers. The required force to cause the threads on the riser to break at the street valve was greatly increased when a schedule 80 riser was used. Based on both the pendulum impact testing and the earlier drop impact testing, it is recommended that schedule 80 risers are installed to focus the break when the meter set is impacted at the breakaway or downstream of the street valve when a breakaway is not installed.

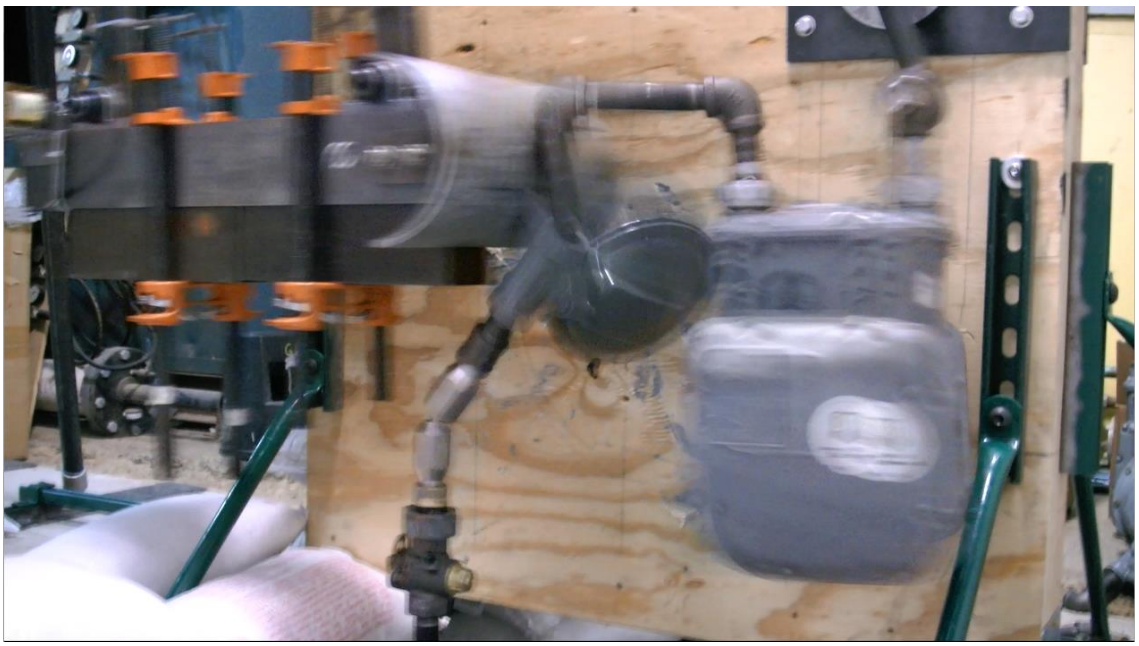

Figure 8: Test with Sch 80 Riser – Successful Breakaway

Drop Testing

In order to simulate falling snow / ice from a roof, a sandbag was raised to a height of 16 feet above the meter set using a forklift (shown below in Error! Reference source not found. **&** Error! Reference source not found.). The sandbag was pulled from the forklift and fell onto the top of the meterset, see the path in Error! Reference source not found. **&** Error! Reference source not found..

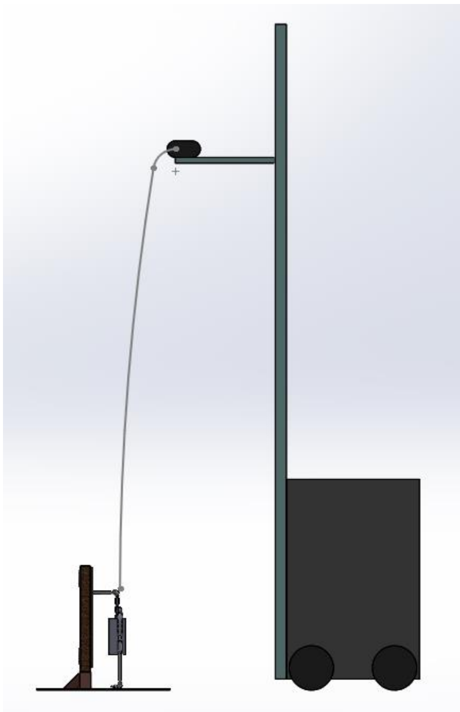

Figure 9: Side View of Path of Sandbag From Drop Test Setup

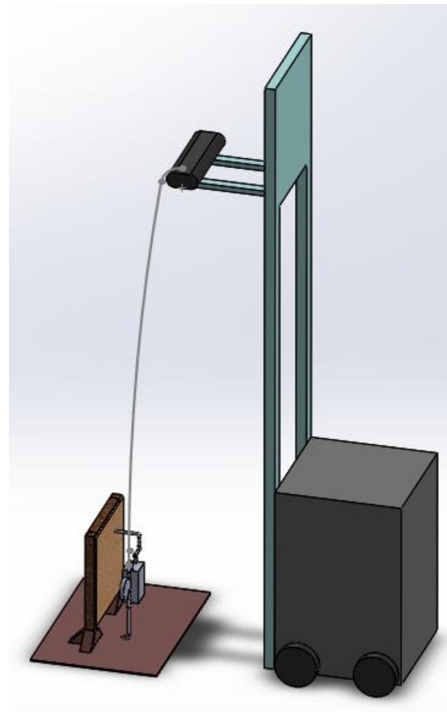

Figure 10: Angled View of Path of Sandbag From Drop Test Setup

Drop testing was conducted on 3 different meter sets with a breakaway fitting installed on the vertical piping just above the service valve. All 3 tests were performed at freezing temperatures (between 28°F and 31°F). In all 3 cases, the breakaway broke successfully under the impact of the dropped sand bag. On one of the tests, the sand bag hit the top of the wall first and then impacted the meter set. Even though this occurred, the breakaway still worked successfully.