

Incident Summary #II-1701876-2024 (#45739) (FINAL)

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| SUPPORTING INFORMATION | Incident Date | April 24, 2024 | |
| | Location | Lake Country | |
| | Regulated industry sector | Gas - Propane system | |
| | Impact | Qty injuries | 1 |
| | | Injury description | One person was inside the building when the explosion took place and received burns and contusions. |
| | | Injury rating | Moderate |
| | Damage | Damage description | The force of the explosion pulled one door off its hinges and forced another closed door open damaging the door and locking mechanism. The building wall was pushed out and three of the appliances had their outer enclosure deformed and dented. |
| | | Damage rating | Moderate |
| | Incident rating | Moderate | |
| Incident overview | An explosion occurred inside a mobile trailer containing 5 gas fueled clothing dryers when they were being started for the first time a day after being connected to a fuel source by a contractor. | | |
| INVESTIGATION CONCLUSIONS | Site, system and components | <p>The facility is a fruit orchard and processing facility that utilizes and houses seasonal migrant workers. Guidelines for seasonal housing for temporary workers in BC from the provinces Seasonal Agricultural Worker Program (SAWP) previously outlined that laundry facilities must include one machine for every 15 beds. As of October 2020, the requirement was increased to be one washing/dryer machine for every 10 occupants.</p> <p>To accommodate for this requirement, the facility obtained a used 24' x 10' ATCO mobile building. The building was outfitted with a new electric water heater and five new Whirlpool stacker laundry washer/dryers connected to a common black iron gas manifold. The building also contained a gas furnace that was not connected for use.</p> <p>Gas fueled clothes dryers use the combustion of gas to heat the air that is used to dry the clothes. When the dryer is turned on for a heat cycle the dryer drum and fan start immediately and a hot surface ignitor is energized and begins to heat up. After a short time-delay, after the ignitor has had enough time to heat up to a temperature that will ignite gas, the gas valve opens to allow gas to flow to the burner to be ignited.</p> <p>Installation and/or fuel conversion of gas appliances at a commercial facility is regulated work that must only be done by a person with a certificate of qualification, a recognized training credential or under the direct on-site supervision of such person. A licensed contractor must not permit regulated work to be undertaken by persons under the control of the licensed contractor if they are not authorized to do so.</p> <p>It is the responsibility of the installer of a gas appliance to ensure <i>before leaving</i> the installation, that the appliance, accessory, component, equipment, or piping and tubing they installed complies with the code requirements, and the person initially activating the appliance shall ensure that the appliance is in safe working order.</p> | |

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| | <p>When a new piping or tubing system is installed, it shall be pressure tested before appliances are connected using an inert gas such as air before it is put into service. After the system has been pressure tested and appliances are installed, the remainder of the connected gas system and appliances, including any openings where gas can escape, shall be tested with either the test dial of a connected gas meter, a pressure gauge, a liquid solution, or leak detecting device.</p> |
| <p>Failure scenario(s)</p> | <p>At a fruit orchard and processing facility, a used mobile washroom trailer was purchased at an auction and stored for future use for migrant worker accommodation to address the upcoming required increase in laundry facilities per number of workers. In 2019 it was fitted with 5 stacker washer/dryer laundry appliances incorporating gas fueled dryers. The appliances were installed, connected to a black iron gas pipe manifold, and converted for use from natural gas to propane gas by the orchard's facilities manager and another employee of the facility. Neither of the employees held certifications required to convert gas appliances to alternate fuels. During the conversion, three of the appliances did not have the gas connection unions upstream of the gas valves tightened, and they remained loose. At that time, the appliances were not connected to a fuel source or fired up and the trailer was stored for future use.</p> <p>Over 4 years later, a new facilities manager was employed, and a decision was made to permanently install the trailer for use. The facilities manager had not been informed from the previous manager of the work that had been done in the trailer or the status of the appliance installation or conversion. The facilities manager contacted a gas contractor and asked for the trailer to be connected to propane. The facilities manager sent a couple of pictures to the contractor and informed them that a propane tank had been delivered but supplied no additional details.</p> <p>Electricians were hired and completed electrical connection to the trailer the day before the incident. The day of the incident a plumber employed by a gas contractor was directed by his employer to attend the scene and connect the appliances to the propane cylinder. The employee was a red seal plumber who has completed his school training and work hours but had not yet written or passed the Class B gasfitter technical exam to receive his certification. Under the regulation, he was still classified as an apprentice who was required to be directly supervised by a qualified person to do the regulated gas work. He was still technically an apprentice who is required to be directly supervised by a person qualified.</p> <p>The plumber reviewed the work scope while onsite and observed an existing propane 2nd stage regulator installed on a black iron gas line that was already connected to the appliances in the trailer. Based on this observation he assumed that the appliances inside had already been set for use with propane gas and planned to verify before completing the work. He did not verify before leaving the site and did not check the appliance tags, the gas valve settings or burner orifices to confirm which gas they were set for.</p> <p>The plumber installed copper gas tubing from the propane cylinder, connected it to the existing black iron gas manifold, and pressure tested the system between the propane cylinder and the 5 individual shutoff valves for the appliances. The plumber verified there were no leaks within the section of pipe he was testing by pressure testing with 20 psi of air for approximately 25 minutes. The plumber identified no pressure was lost during that time indicating that section of piping was free from leaks. The plumber did not do the required examination of the gas system or leak testing downstream of the appliance shut off valves that were already connected</p> |

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when the job began that day. Access panels were installed on all the appliances and the loose connections on the gas valve unions were not visible or assessable unless the access panels were removed. He then connected the gas from the propane tank to the existing gas system and informed the facilities manager that the work was complete and asked the facilities manager if he wanted the gas turned on. The facilities manager told him he didn't need to turn the gas on, and he would be by the next morning to start the dryers and check their operation. The plumber did not turn the gas on after making the final piping connection to the propane tank regulator and did not purge air from the piping system.

After leaving the site, the plumber contacted his employer via text message and informed him that he did not check if the appliances were set up for operating on propane. The contractor did not immediately notify the facilities manager that the appliances had not been checked. The next morning the facilities manager arrived on site, and he was informed by the plumber that the job was complete and was "ready to go". He entered the trailer and checked that the electrical was on then he went to the propane cylinder and slowly opened the service valve and heard the regulator operate until the pressure in the piping had equalized. He then went into the trailer through the one of the doors and heard a high-pitched sound. At that time, he did not smell any gas and texted the plumber a video asking him what the sound was from the back of the appliances. The gas piping was still full of air and had not been purged so the odor of the propane was delayed in reaching the indoor space. The sound was air and gas escaping from the three loose gas valve connections on the dryers from when the fuel gas conversions were previously done. He then turned on the first gas dryer, which started the dryer drum, air fan, and began the burner ignition sequence. He then turned on the second dryer. Once the air had been purged out of the gas piping propane vapor began leaking from the loose connections on the appliances and began filling the enclosed space. eventually the first dryers hot surface ignitor got hot enough and ignited the gas-air mixture in the space causing an explosion that forced the one door open outward and the ripped the inward facing door off the hinges. After the explosion, the facilities manager exited the trailer, removed his shirt, doused himself with water, shut off the tank and called 911. He was taken to hospital, treated for burns to his face and arms and was released early the next morning.

Facts and evidence

Interviews

Contractor:

- They do not have any procedure or checklist to follow when connecting or commissioning gas appliances.
- The plumber had been employed by them for approximately seven years and had completed his entire plumbing apprenticeship with them.
- He was aware that the plumber hadn't written or passed his "Class B" gasfitter exam.
- He was informed by the plumber after they left site that the work was completed but they hadn't verified that the appliances were correctly converted to propane gas.
- He was unaware of what communication had taken place between the plumber and the facilities manager and he did not inform the facilities manager that the appliances hadn't been checked and that more work needed to be done to safely complete the installation.

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Plumber:

- The 5 gas dryers had already been installed in the trailer and connected to a black iron gas pipe manifold before he started connecting the system to the propane cylinder.
- When he first arrived, he saw a propane second stage regulator attached to the black iron gas pipe manifold on the front of the trailer.
- He assumed that the appliances had already been converted for use on propane gas but did not examine them to confirm.
- He removed the old propane regulator and capped off the black iron gas line then ran a new copper gas line from the propane cylinder and connected it to the system.
- He had pressure tested the gas line between the propane cylinder and the appliance shut off valves but did not test for leaks downstream of the valves or within the appliances.
- He did not ever turn the gas supply from the propane cylinder on and had not purged air from the gas lines.
- He spoke with the facilities manager and informed him the job was done and asked if he wanted the gas turned on and the facilities manager told him no and that he would be arriving the next morning to start the appliances.
- After leaving the site he realized he had not confirmed the appliances had been converted for use on propane and called his supervisor to inform him but did not inform the facilities manager.
- On the morning of the incident at 8:47am, the facilities manager texted him a video and asked him what the noise was coming from behind the machine. A couple of minutes at 8:52am he texted again and said the dryer blew up in his face.

Facilities manager:

- He had been hired by the company in 2021 as the facilities manager and was responsible for maintaining the seasonal agricultural worker facilities.
- They were permanently installing the laundry trailer to adhere to the required number of laundry facilities for the seasonal workers.
- He was unaware of the work that had been done or the status of the previous appliance installation or fuel conversion by the previous facilities manager.
- He contacted the contractor to connect gas to the dryers inside the trailer.
- He had been by the plumber that the gas work was complete, and the gas lines had been pressure tested and had not received any further communication from the plumber or contractor.
- In the morning, he turned the gas on at the propane cylinder and when he went inside he heard a high-pitched sound from the rear of the appliances and texted the plumber a video asking him what it was.
- He did not immediately smell gas inside the trailer.
- He turned on the first gas dryer then proceeded to turn on a second dryer.
- The explosion occurred as he was standing in front of the second dryer knocking him to the ground.
- He exited the trailer, removed his shirt, doused himself with a bottle of water and called 911.

Previous facilities manager:

- He had been the facilities manager in charge of maintaining the foreign worker camps for ten years.

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- They purchased the trailer at an auction in 2015 and it was stored at the facility unused until 2018.
- He along with another employee of the facility installed the five new laundry appliances in the trailer and did the fuel conversions in 2019.
- The appliances were never connected to a fuel source or turned on and the trailer was stored until 2024.

Site observations

- A new copper gas line was connected between the propane cylinders and a black iron gas piping manifold.
- The data tags on all five of the appliances identified they were factory set for use with natural gas.
- The factory natural gas orifices were found in a conversion kit bag inside the building.
- Four of the appliances had gas conversion decals installed on the gas valve brackets that were only visible by removing the gas valves and one appliance had the conversion decal installed on the rear of the appliance that was visible from the rear of the appliance.
- None of the appliances had gas record labels supplied with the conversion kits applied that identify the date of conversion and the name and address of the organization making the conversion, who accepts the responsibility for the correctness of the conversion.
- Three of the five gas connection unions on the dryers that were behind closed access panels were loose.
- The mobile trailer had two damaged doors and the back wall behind the appliances had been pushed out from the force of the explosion.

Testing and measuring

- Removal of the gas valves on all five appliances showed that they had all been converted from the factory settings and all of them had gas orifices and regulator caps for use with propane gas installed.

Documents

- The installation manual for the dryer states that propane gas conversion of the dryers must be made by a qualified technician.
- The installation instructions for the propane gas conversion kits show disconnection of the union nut to gain access to the gas valve for conversion and instructs to tighten the union nut securely upon reinstallation and to check for leaks with a leak detecting solution.

Video

- The video that was texted to the plumber from the facilities manager identified a high pitch sound of gas leaking coming from the rear of the appliances and showed all the appliance valves in the open position.

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Causes and contributing factors

The leaking gas connections on the dryers allowed propane gas to leak indoors. The activation of the dryers created a source of ignition that likely ignited the air/fuel mixture creating the explosion.

The contributing factors to the incident include:

Incomplete regulated work

- The conversion of the appliances not being completed at the time of first installation left them in a state that leaked gas when they were connected to a fuel source.
- The uncertified plumber not checking for leaks downstream of the pressure test allowed the gas leak to occur when the fuel was turned on by the facilities manager.
- The gas piping not being purged of air by the plumber allowed the leak to begin without it immediately being identified by the odour by the facilities manager.

Ineffective communication

- Ineffective communication between the previous facilities manager and the new facilities manager allowed for a misunderstanding of the status of what work needed to be done to safely complete the installation.
- The plumber informing the facilities manager that the job was complete and “ready to go” when he had not completed all of the required steps to ensure the appliances were safe for operation and the contractor failing to inform the farm manager the appliances had not been fully checked after he was informed by the plumber both led the facilities manager to believe the system was safe for operation when he opened the gas supply and started the appliances.



Image 1 – Laundry trailer showing door damaged from explosion.



Image 2 – Rear of trailer showing damage from explosion and fire department overhaul.



Image 3 – Five Stacker washer and gas dryers installed in trailer.



Image 4 – Rear of appliances showing factory appliance connectors, pre-existing gas manifold and shut off valves, and new copper gas tubing and brass fitting.

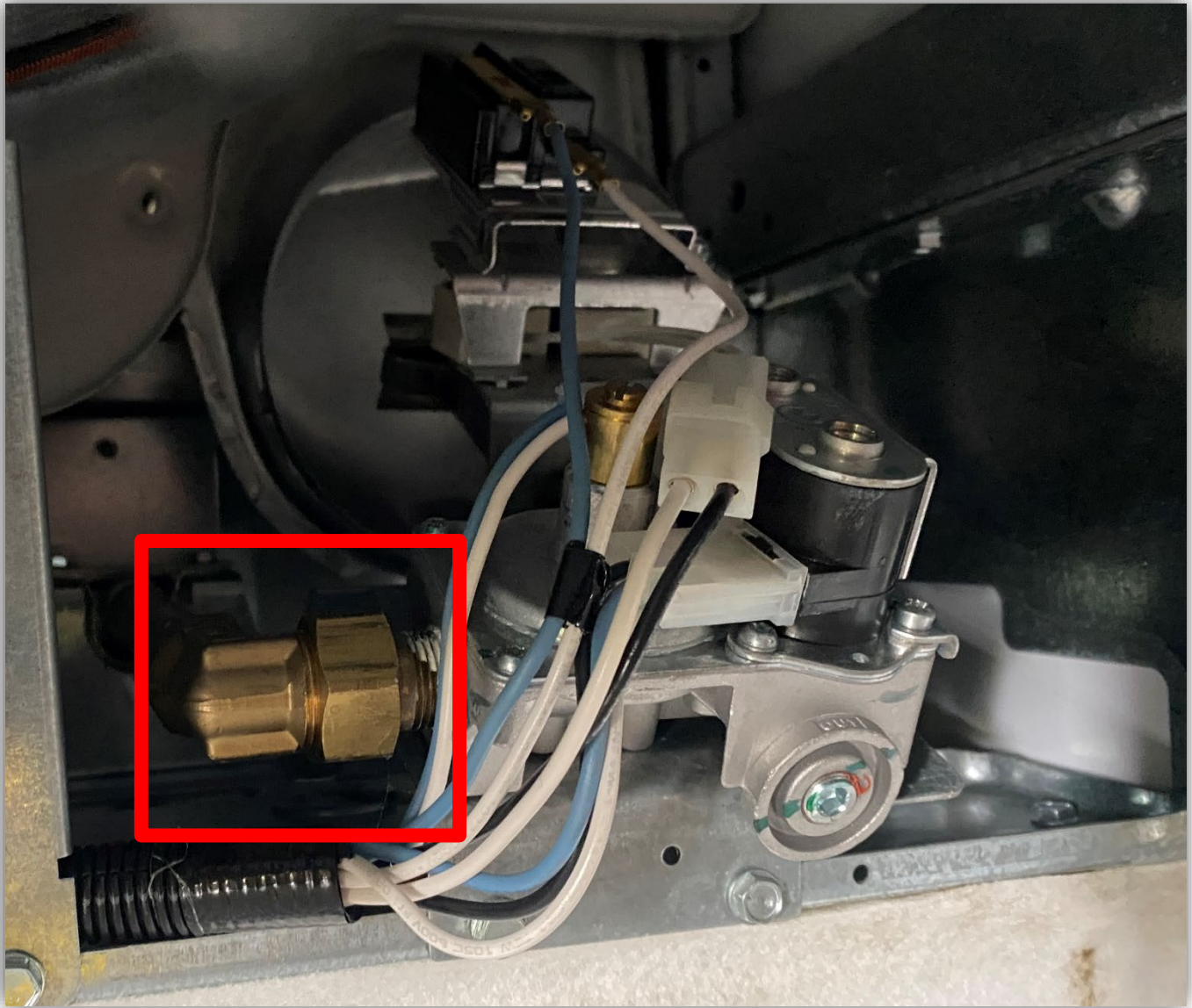


Image 5 – Dryer gas valve. Tight gas union connector.

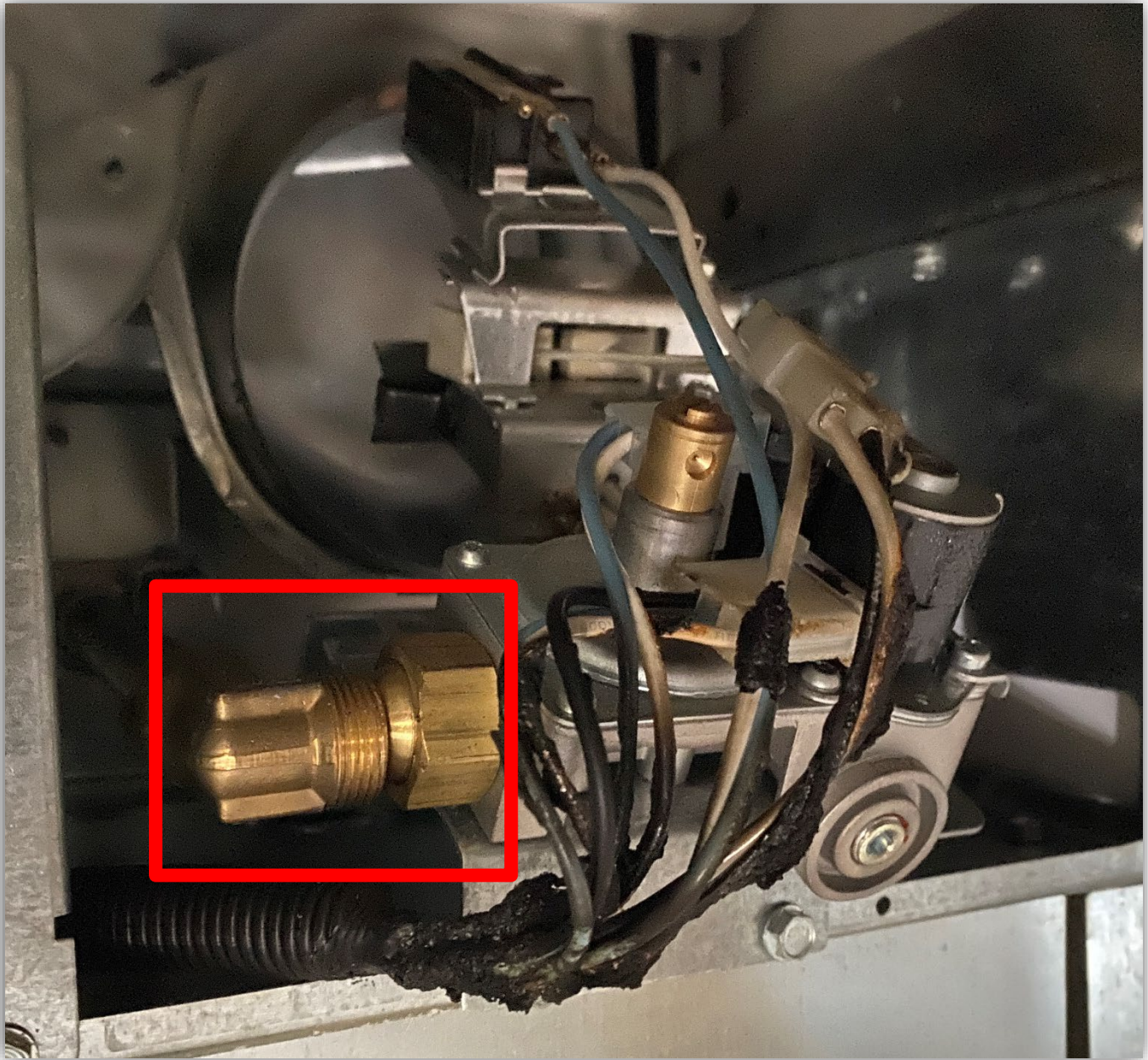


Image 6 – Dryer gas valve. Disconnected gas union connector (Union was loose but not fully disconnected at the time of the incident) and burnt wiring insulation.



Image 7 – Inspection panel for access to dryer gas valve.

5. Disconnect the gas supply by loosening the union nut connecting elbow or manual shut-off valve located at the gas valve. See *Figure 1*.

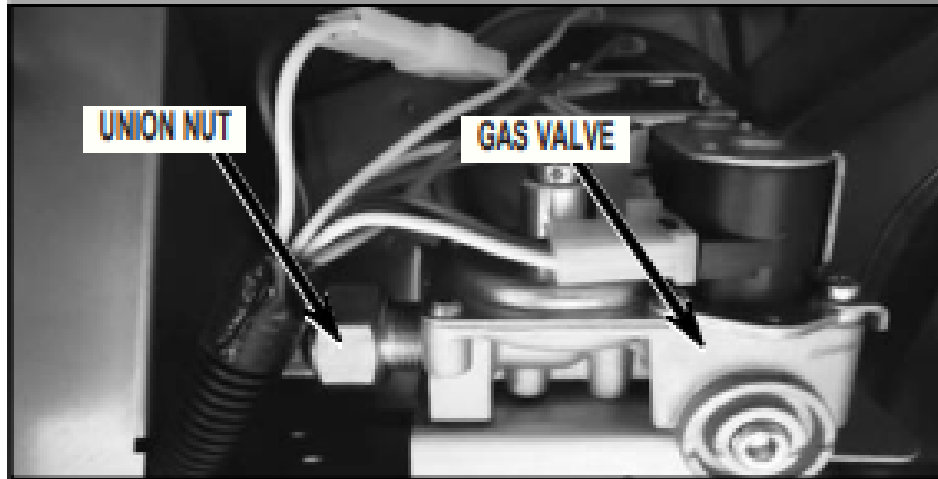


FIGURE 1

(continued)

Image 8 – Gas conversion kit instructions showing the disconnection of the union nut for removal of the gas valve.

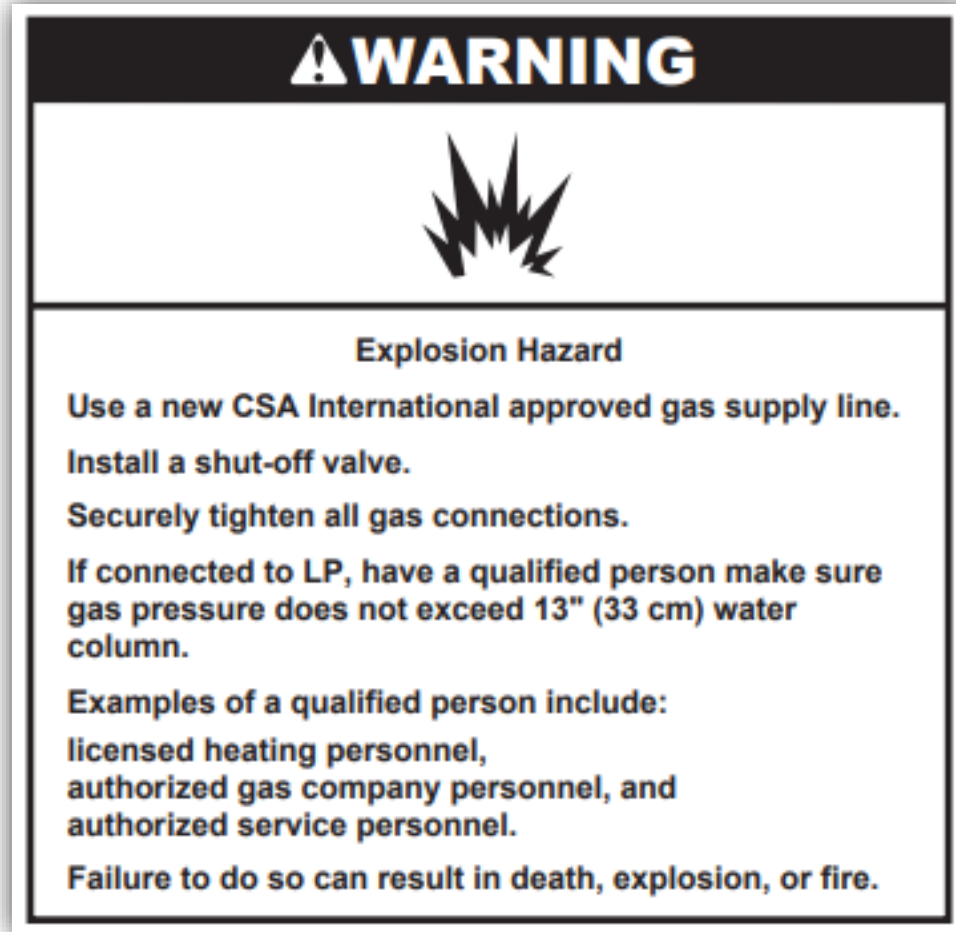


Image 9 – Explosion Hazard warning label from the gas conversion kit installation instructions.

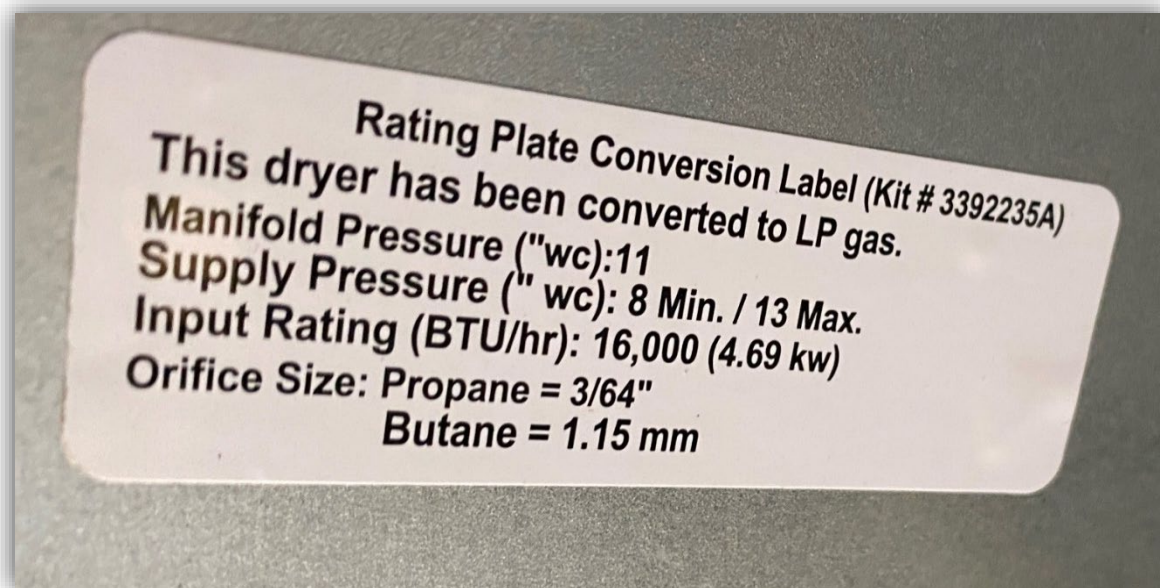


Image 9 – Gas appliance conversion decal installed on inside of dryer access panel near gas valve.

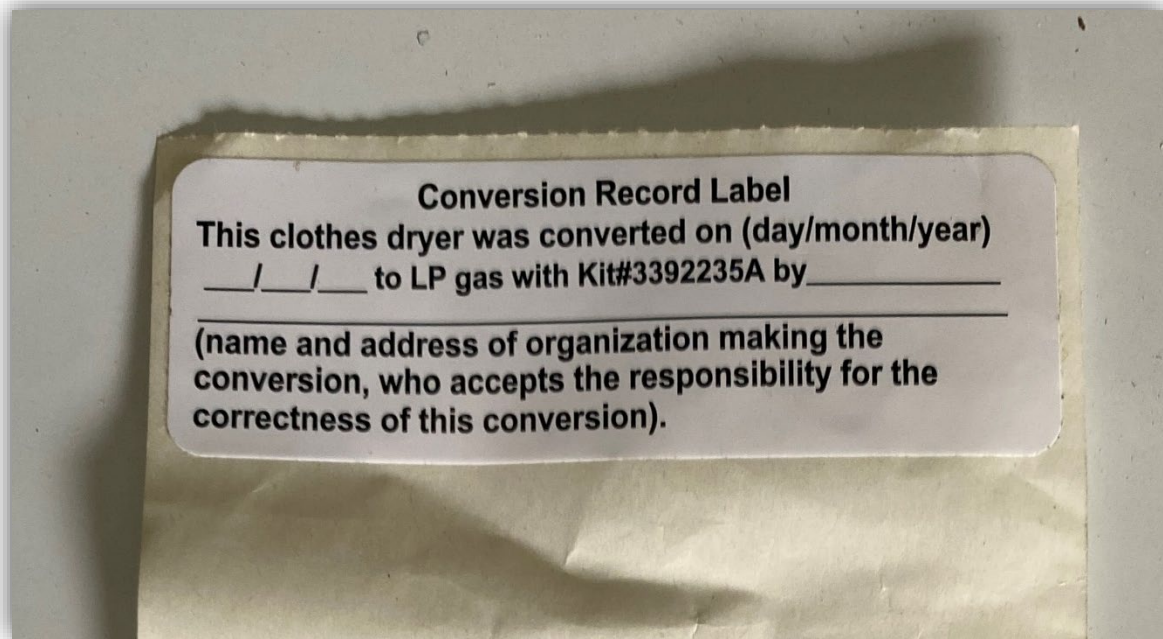


Image 10 – The conversion record label that was not filled out or installed on any of the appliances.