

Incident Summary #II-1950799-2025 (#58362) (FINAL)

SUPPORTING INFORMATION	Incident Date	August 10, 2025	
	Location	Port Coquitlam	
	Regulated industry sector	Gas - Propane system	
	Impact	Qty injuries	0
		Injury description	N/A
		Injury rating	None
	Damage	Damage description	One 60-pound propane cylinder split open instantly releasing all of its contents. The force of the explosion ripped the metal cylinder cage door off of its hinges, dented and deformed other propane cylinders in the cabinet and propelled multiple cylinders across a parking lot.
		Damage rating	Moderate
Incident rating	Moderate		
Incident overview	Seven propane cylinders were stored in a metal cylinder storage cabinet outside of a commercial business in a business park. One full 60-pound propane cylinder in the cabinet suffered a catastrophic pressure boundary failure and split open instantly releasing all the propane contained inside.		
INVESTIGATION CONCLUSIONS	Site, system and components	<p>Propane is stored as a liquid under pressure in tanks or cylinders and is typically used by appliances as a vapor. Cylinders are always filled to a maximum level of 80% liquid leaving a vapour space to allow for liquid expansion. Pressure is equalized between the liquid and vapour and rises with increases in temperature. During use, vapour is withdrawn from a cylinder reducing the pressure and the liquid boils and vaporizes until the pressure within the cylinder equalizes. Liquid propane expands 270 times in volume when it converts from a liquid to a vapour.</p> <p>Pressure relief valves on propane cylinders are safety devices designed to protect the cylinder from over-pressurization. They are typically located in the vapour space near the top of the cylinders and remain sealed under normal conditions, keeping the propane safely contained. If the internal pressure rises above the set pressure, often due to overfilling or heat exposure, the valve automatically opens to release gas vapour, lowering the pressure to a safe level. Once the pressure drops below this threshold, the valve incorporates a spring which closes the valve and stops the release. For standard propane cylinders, this valve is usually set to open at around 375 psi (25.8 bar).</p> <p>Since 2008, Canadian regulations have required all refillable propane cylinders with a capacity of four to 40-pounds to have a valve equipped with an Overfill Prevention Device (OPD) to enhance safety. An OPD is a special valve mechanism that automatically stops the filling of the cylinder when it reaches about 80% of its capacity, preventing overfilling. These valves are identified by their triangular-shaped handwheel and the letters "OPD" stamped on the valve itself. This safety feature helps protect against the risk of propane release due to overfilled tanks. Propane cylinders over 40-pounds do not require to have an OPD safety device.</p>	

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In Canada, portable propane ***cylinders***, regulated by Transport Canada, must not be filled unless they are recertified every 10 years from the date of manufacture. This process involves a visual inspection for damage, corrosion, and leaks, and includes replacing the pressure relief valve. Only certified facilities are authorized to perform this requalification, and once complete, the cylinder is stamped with a new date indicating its extended usability. In contrast, propane ***tanks***, which are larger, stationary vessels, are built to **ASME** standards and do not require recertification in the same way. These tanks are considered permanent installations and are subject to different inspection protocols, such as periodic checks by qualified professionals, but they are not governed by the 10-year expiry rule that applies to cylinders.

Persons who fill and re-certify cylinders in BC are required to complete training modules from third-party training providers that are recognised and approved by the authority having jurisdiction (Technical Safety BC).

Codes and Regulations

Propane cylinders approved for use in Canada must adhere to the adopted codes and regulations which ensure they are safely designed, filled, stored, used, transported, recertified, and have properly selected and sized relief valves.

The B149.2 Propane storage and handling code is adopted in BC and contains the following requirements

- Propane shall only be transferred from one container to another by a person who is the holder of a certificate recognized by the authority having jurisdiction.
- A person filling a container shall be responsible for ensuring that the maximum permitted filling density is not exceeded.
- A cylinder shall be filled by either weight, or volume when the cylinder is equipped with a fixed-liquid-level gauge designed for the cylinder.
- The maximum filling density of a cylinder by weight is 42% of its water weight capacity, and the maximum filling density of a cylinder by volume is 80% fill level.
- Refillable cylinders shall be manufactured, tested and inspected in accordance with the requirements of the CSA-B339 standard for cylinders for the transportation of dangerous goods.
- Each cylinder shall be provided with a relief valve that meets the requirements of CSA B340 standard for selection and use of cylinders for the transportation of dangerous goods.
- Propane shall not be put into a cylinder that does not conform with the requirements of CSA B340.
- The requalification of cylinders shall be as prescribed by the requirements of CSA B339 and shall have the relief valve removed and replaced with either a new relief valve or one that has been tested to and complies with CGA S1.1 Pressure relief device standards – Part 1 – Cylinders for compressed gases.

The **CSA-B339 standard** referenced in the B149.2 contains the following requirements:

- Pressure relief devices and container valves shall be in accordance with CSA B340.
- Pressure relief devices shall be periodically replaced or requalified in accordance with CGA S-1.1.
- Where the valve on a container is replaced and the container has a marking indicating a fixed liquid-level gauge (dip tube) length, the replacement valve

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shall have a fixed liquid level gauge with the same length as marked on the container.

- Individuals responsible for performing requalification's shall be in possession of a valid training certificate.
- Containers built to the specification of TC-4BWM are steel cylinders with a service pressure range from 1.5-3.5MPa (217-507psi).
- One cylinder from each lot of 200 or less shall be tested to two times its service pressure and shall not show defects or leaks.
- One cylinder from each lot of 500 or less shall be tested to four times its service pressure without bursting.

The **CSA B340 standard** referenced in the B149.2 contains the following requirements:

- Container valves and accessories shall be installed, repaired, and maintained by personnel trained for that purpose.
- Cylinders shall be equipped with pressure-relief devices sized and selected in accordance with CGA S-1.1.

The **CGA S-1.1 standard** referenced in the B149.2 contains the following requirements:

- Each cylinder shall be equipped with one or more pressure relief devices.
- Pressure relief devices shall be suitable for the intended service.
- All pressure relief valves on portable propane cylinders shall be replaced or requalified within 10 years after the date of manufacture of the relief valve.

Safe filling of propane cylinders

Overfilling a propane cylinder that lacks a pressure relief valve poses a serious safety hazard that can lead to a catastrophic explosion. Propane tanks are intentionally designed to be filled only to about 80% of their capacity, leaving a vapor space at the top to accommodate the natural expansion of liquid propane as temperatures rise. When this space is eliminated due to overfilling, even a modest increase in temperature can cause the liquid propane to expand and dramatically increase internal pressure.

Normally, a pressure relief valve would release excess pressure to prevent danger. However, if the valve is missing or malfunctioning, the pressure continues to build. Eventually, the tank's metal casing can no longer withstand the stress, leading to a sudden and violent rupture. This rupture initiates a BLEVE (Boiling Liquid Expanding Vapor Explosion). A BLEVE is a catastrophic explosion caused by the sudden failure of a pressurized vessel containing a liquid that has heated above its atmospheric boiling point (*The atmospheric boiling point of propane is -44°F (-42°C)*). The high-temperature liquid undergoes rapid flash boiling, creating a massive pressure increase that causes the vessel to rupture, expelling a large, fast-expanding cloud of vapor. If the vapor is flammable, such as propane, it can ignite and form a dangerous fireball, leading to high heat radiation and a destructive blast wave.

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Failure scenario(s)

The 60-pound propane cylinder was originally manufactured by Manchester Tank and Equipment Co. in September 2005. The cylinder was designed and manufactured to meet the TC-4BWM specification and other requirements from the CSA B-339 standard.

The cylinder was in regular service until it surpassed its certification life of ten years after the manufacture date. The cylinder was recertified on April 17, 2019, at a facility registered with Transport Canada by an employee holding a training certification from the Canadian Propane Association's Propane Training Institute (PTI) for "*Cylinder inspection and re-qualification of propane cylinders*". During the recertification, the original cylinder service valve, which incorporated an appropriately sized relief valve device and fixed liquid level gauge dip tube, was replaced with an incorrect service valve without a relief valve or fixed liquid level gauge. The installation of the service valve rendered the cylinder unprotected from excessive pressures that could damage the cylinder. The cylinder was put back into service and remained in service for over 6 years without overpressure protection. Visual inspections of the cylinder during each fill and transport never identified the missing required relief valve. Although the company's procedure for recertifying cylinders did not specifically address the correct selection of valves for the cylinders being recertified, it did require pre-requisite training and competencies from the approved third-party training modules including the 100-04 *Cylinder Inspection and Re-Qualification* which does cover the correct selection of service valves.

In Summer 2025 the cylinder was overfilled at a commercial propane bulk plant and cylinder filling facility. 60-pound cylinders are uncommon in the company's region and infrequently filled at the facility. All employees filling cylinders at the facility had the required recognized certifications for transferring propane into cylinders and had been trained to the company's safety procedure for filling propane cylinders by weight. The cylinder was filled by weight using weight scales located on the propane suppliers cylinder filling dock. The cylinder filling scales all utilize Fisher N201 automatic cylinder filling valves which stop the flow of propane into a cylinder when the scale beam rises when it reaches the scales set weight and contacts a microswitch triggering the valve. During filling of the cylinder, it likely that either an incorrect scale set weight or a non-functioning automatic cylinder fill valve resulted in the propane cylinder being overfilled to likely above 95% full. The overfilled cylinder was stored on the dock in a storage area with other filled cylinders until it was loaded onto a cylinder delivery truck and transported and delivered to the client's location on July 31, 2025, ten days before the incident. The cylinder was placed inside a locked metal cylinder storage cabinet with six other propane cylinders outdoors in front of the client's facility.

At the client's facility there were two other 60-pound propane cylinders that were connected for use inside the building but there had not yet been a need to replace those cylinders, so the overfilled cylinder remained in the storage cabinet outdoors until the incident. On August 10th, the day of the incident it was a Sunday and the client's business along with several of the neighboring business in the commercial business park were not open. This reduced the amount of people, mobile equipment and vehicles that would have typically been in the area of the cylinder storage cabinet during the week when the businesses were open. The ambient outdoor temperatures in the area had been steadily increasing over the past 5 days from a high of 21°C to a high of 30°C on the day of the incident.

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Although the cylinder had not had a pressure relief valve for over 6 years of service, proper filling of the cylinder would have prevented an increase to its internal pressure beyond the required relief valve set pressure of 375psi during typical storage and use. When the cylinder was overfilled, the increase in temperature reached the point the tank became “liquid full” and thermal expansion of the liquid inside quickly spiked the internal pressure beyond the burst pressure of the cylinder ([Chart 1](#)). The pressure likely exceeded the manufactures required test pressure without bursting of four times the service pressure (up to 1500psi). The cylinder split open and the propane within the cylinder rapidly converted from a liquid to a vapour causing a BLEVE explosion blowing the door off the cylinder cabinet and damaging and scattering the other propane cylinders from the cabinet across the parking lot.

Statements

Propane customer

- They use the 60-pound propane cylinders for handheld torches for their business process.
- Two 60-pound cylinders are typically stored indoors attached to the torches and two full cylinders are typically stored in a locked cylinder cabinet outdoor for replacements.
- The incident happened on a Sunday when they weren't open and there were no employees around.
- The only damage was to the cylinder cage and cylinders inside. There was no damage to the building or surrounding vehicles.

Propane supplier

- They have documented safe working procedures including:
 - Safe filling of propane cylinders by weight.
 - Recertification of propane cylinders.
 - Handling of an overfilled cylinder.
- The employee who re-certified the cylinder was experienced, trained and qualified to do so at the time they installed the new valve in the cylinder in 2019.
- 60-pound cylinders are uncommon and there are only approximately 12 that are infrequently filled at the filling location that the cylinder was filled.
- When cylinders are filled at the location they are placed on a scale and the scale is manually set to tip at the weight of the empty cylinder plus the weight of the fill nozzle and 42% of the water capacity stamped on the cylinder's collar which is the weight of the liquid propane when the container is 80% full.
- The scales all utilize automatic cylinder filling shutoff valves that stop the flow of propane into the cylinder when activated.
- When cylinders come in empty they are typically filled and stored full on the cylinder filling dock or transport truck until they are delivered to the next customer.

Documents

- The invoices for the cylinder delivery show the last time full 60-pound cylinders were delivered was July 31, 2025, ten days before the incident.
- The catalog for the Sherwood 3250AD service valve identifies that the valve is only to be used when a separate pressure relief device is provided.

Facts and evidence

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The propane pump attendant 100-01 training manual

- Before filling any cylinder, the cylinder must receive a pre-fill visual examination or inspection.
- If a cylinder is overfilled the excess propane liquid must be removed before the cylinder is returned to the customer.

The cylinder inspection and re-qualification 100-04 training manual

- The relief valve discharge pressure for a cylinder is 375psig, it will be stamped on the body of the valve.
- The relief valve must be replaced with a correctly pressure rated valve.
- When a cylinder valve is replaced, you must ensure the replacement valve meets the requirements of the CSA B149.2 and the CSA B340.
- When replacing a valve with a dip tube, make sure the fixed liquid level gauge is correct for the application, and the dip tube is the exact length required.

Surveillance Video

- Video from a neighboring unit captured the cylinder explosion and showed a rapid release of liquid propane.
- The propane was observed dissipated without igniting.
- The cylinder cabinet was blown open and the cylinders inside were shown scattering across the parking lot.

Site observations

- The propane filling plant has six scales used for filling cylinders including 60-pound cylinders.
- The scales are equipped with Fisher N201 valves to automatically stop the filling of the cylinders when the scale beam tips up at its set weight.
- Two signs were observed on the cylinder fill dock with scales and guidance for filling cylinders both by weight and by volume.

Causes and contributing factors

The increase in temperature caused the pressure inside of the overfilled propane cylinder to rapidly increase. The incorrect service valve without the required pressure relief safety device allowed the pressure to continue to increase beyond the burst pressure of the cylinder causing the explosion. Redundant checks and balances were ineffective at identifying that the propane cylinder was at risk of explosion.

Contributing factors to the incident include:

- An incorrect service valve being selected and installed in the cylinder during requalification by a qualified employee.
- The incorrect valve in the cylinder not being identified during typical filling and transport during the six years of operation following the cylinder requalification.
- The overfilling of the cylinder did not provide enough vapor space in the cylinder for liquid expansion during a rise in temperature.

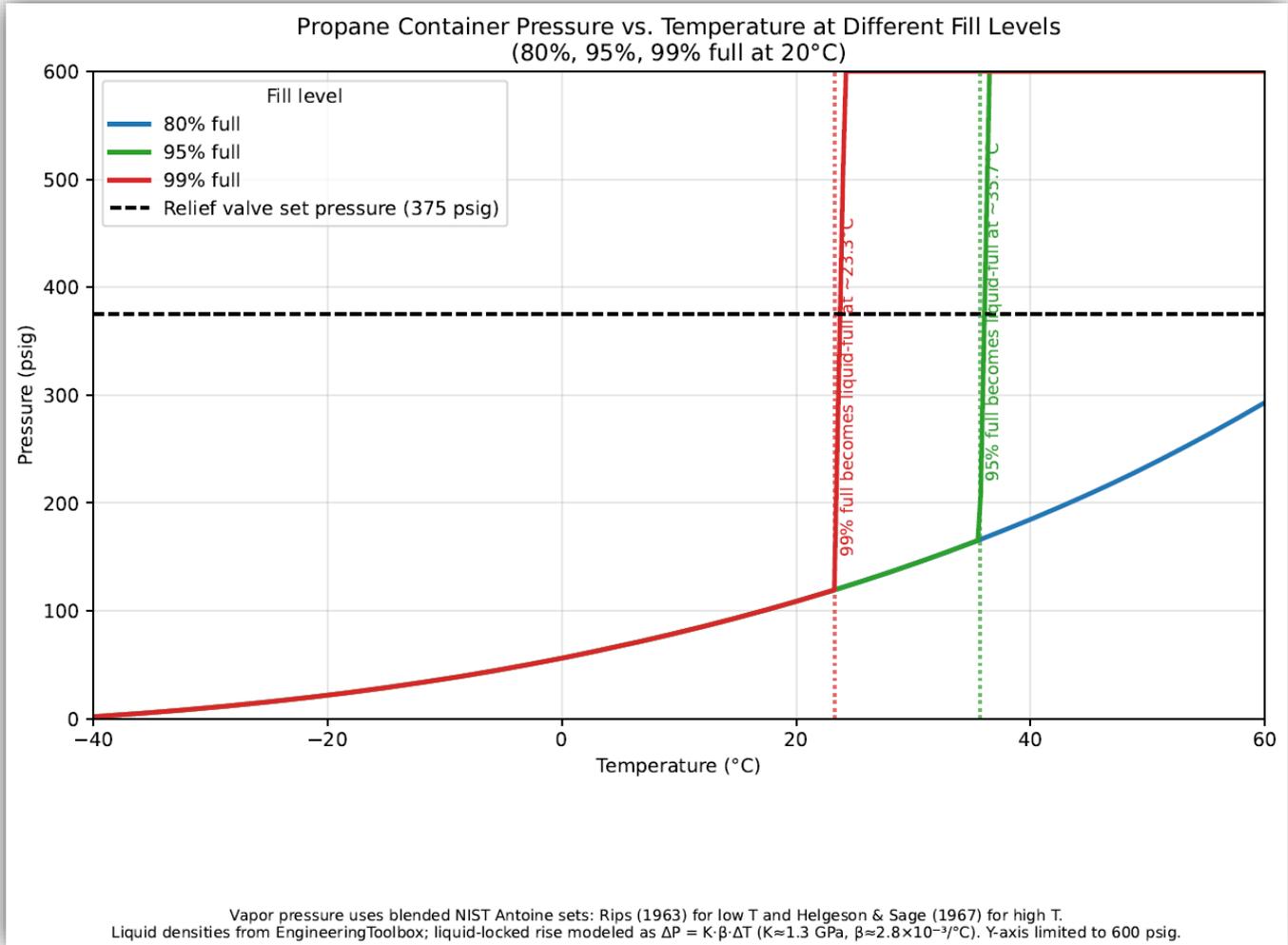


Chart 1 – Showing rapid pressure increases of overfilled propane containers (95-99% full) vs typically filled (80% full). Black dashed line showing typical 375psi relief valve setting.



Image 1 – The cylinder cabinet prior to the incident.

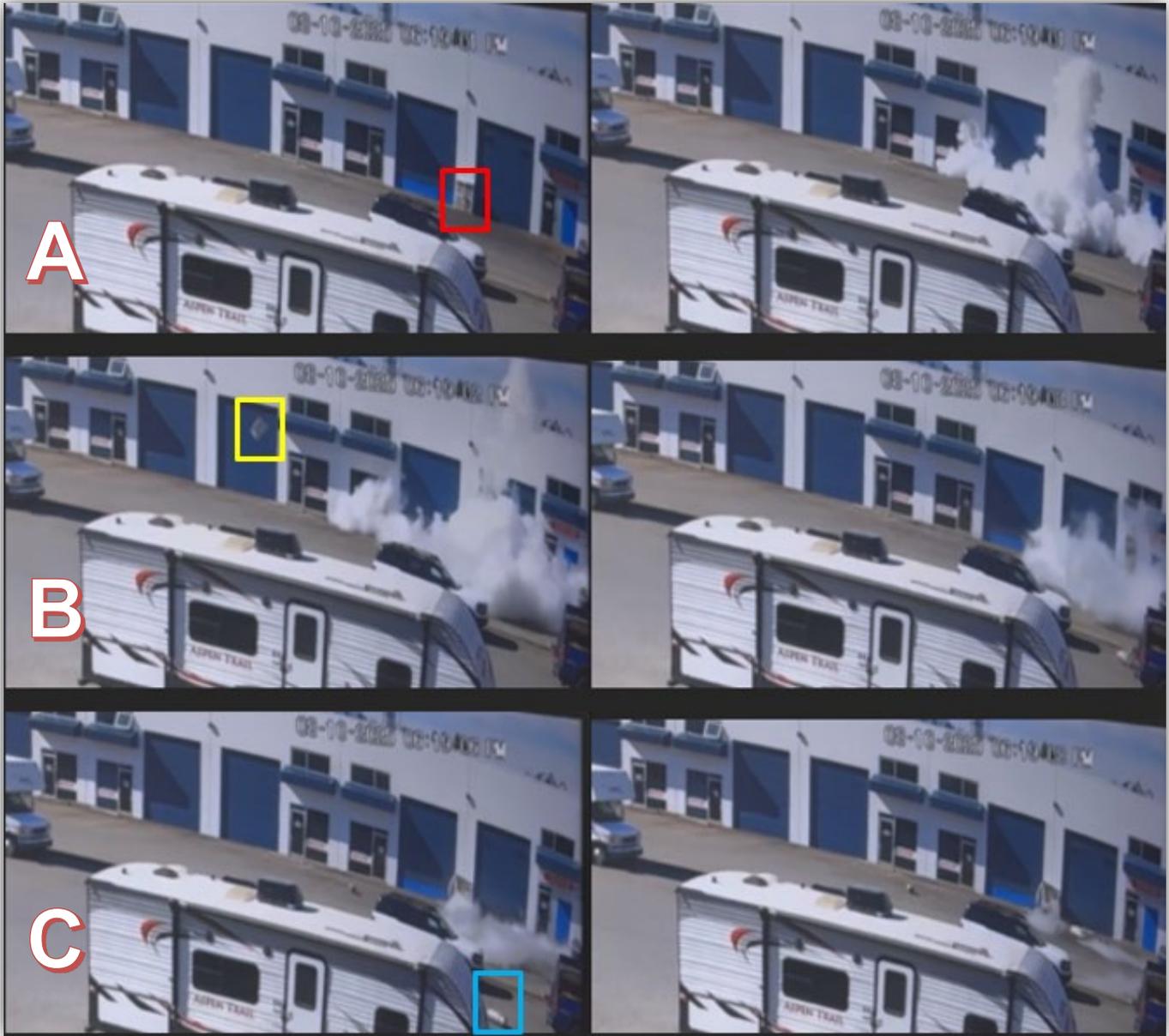


Image 2 – Stills from security footage. **[A]** Cylinder cabinet before explosion. **[B]** Airborne projectile from explosion. **[C]** Resting location of one of the cylinders from the cabinet.



Image 3 – Damaged cylinders and cabinet.



Image 4 – 60-pound propane cylinder split open from BLEVE.



Image 5 – 60-pound cylinders side by side for comparison.



Image 6 – Cylinder collar showing original manufacture date, tare weight, water capacity, dip tube length and the recertification date of 04, 2019 and the recertification facilities Transport Canada code.



Image 7 – Sherwood 3250AD service valve removed from damaged cylinder without a dip tube or relief valve.

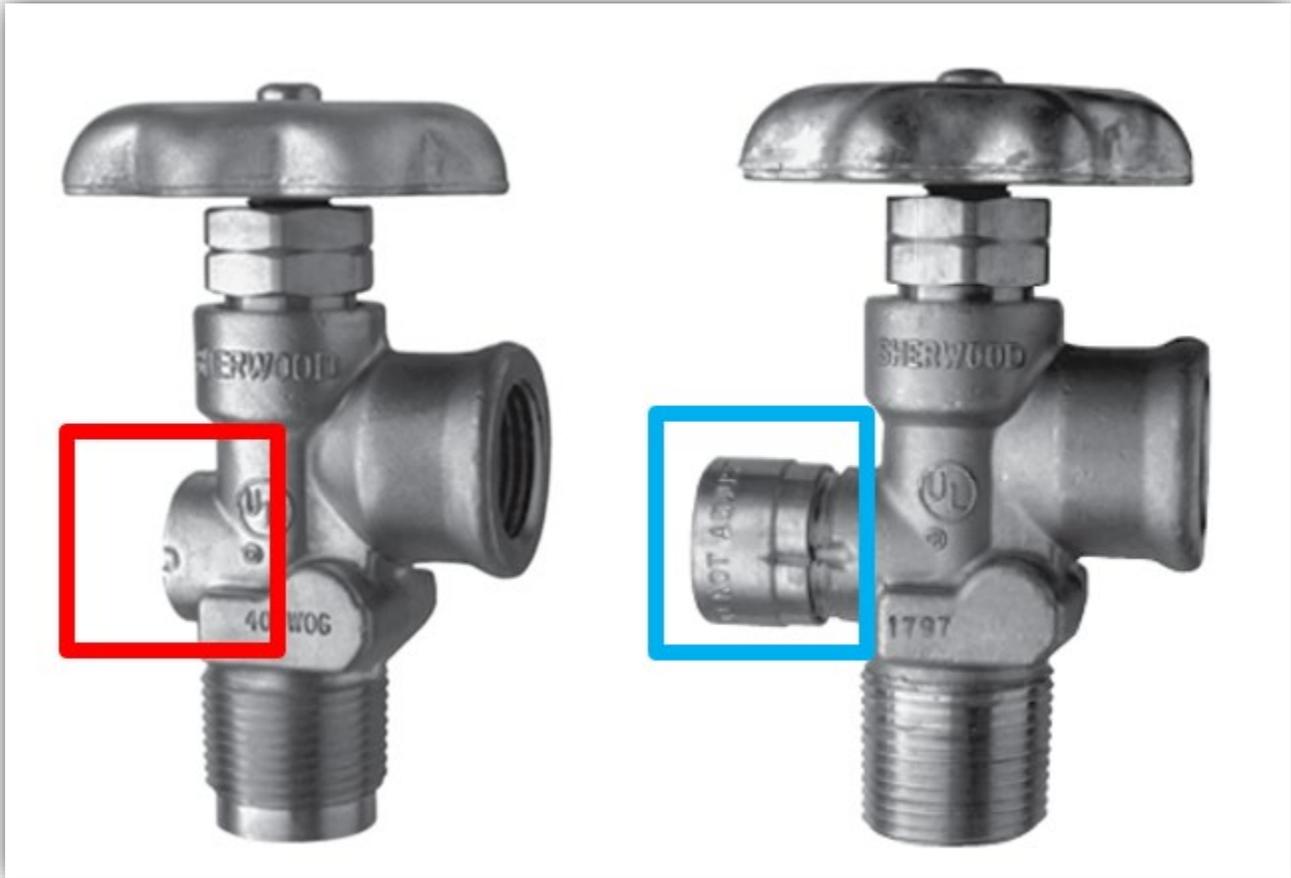


Image 8 – Example of similar propane cylinder service valves. Left valve is without an integrated relief valve and right valve has an integrated relief valve.



Image 9 – Cylinder fill scales at the propane supplier's facility.



Image 10 – Fisher N201 automatic cylinder filling valve on one of the scales.

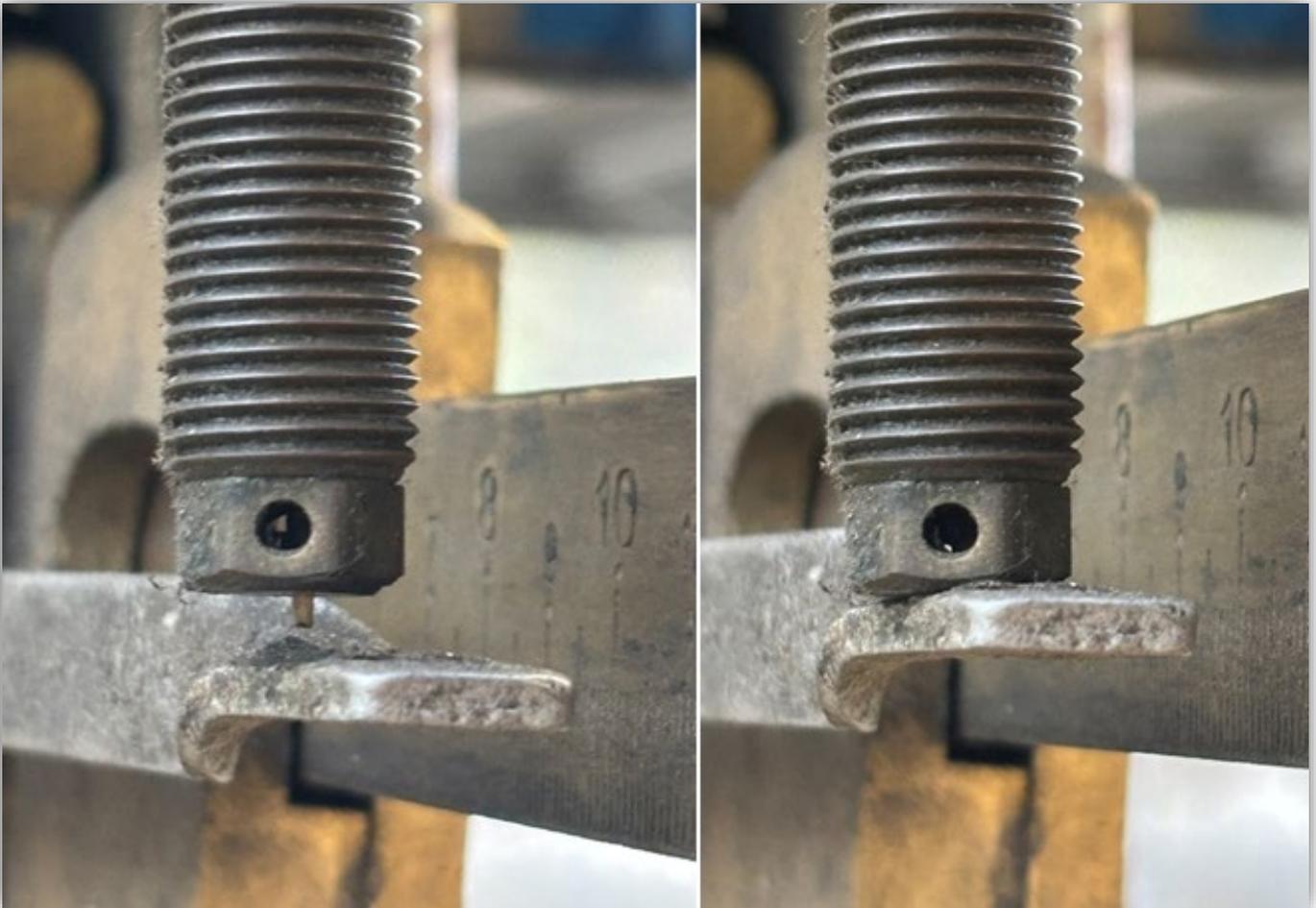


Image 11 - Fisher N201 automatic cylinder filling valve trip valve in the on position (Left) allowing flow to the cylinder, and in the closed position (Right) stopping flow to the cylinder when the scale beam tips at its set weight.