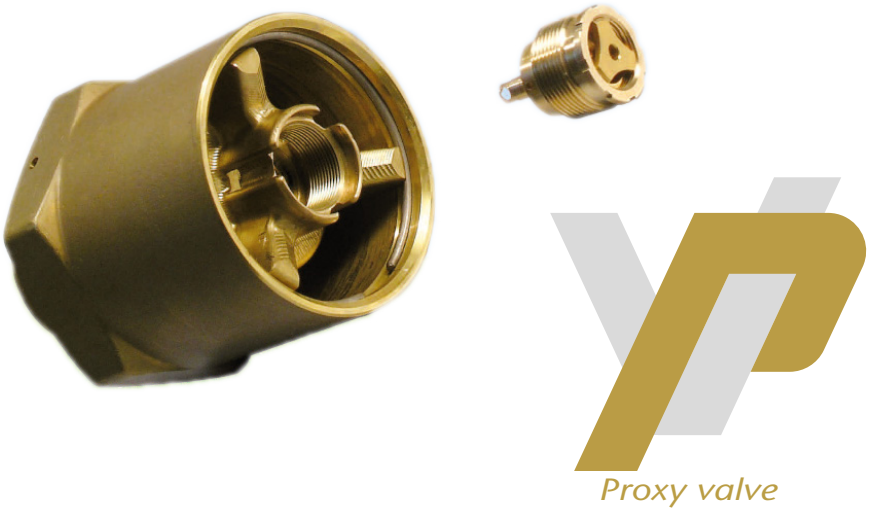
CAVAGNA Proxy Valve (PV) Series

The Innovative LPG Pressure Relief Valve for Tanks with a Replaceable Calibration Cartridge

cavagna group

Wherever gas is used, we are there



Proxy valve

Our first 'Cavagna Classics' post revolves around the LPG PV Series of Vales.

While the relief valve is one of our original 'classics' the PV version is an adaptation and improvement on the classic. Actually, this could be considered a 'modern classic' as they have been produced by the Cavagna Group Omeca division and used in Italy since 2009 and are currently active in Belgium, Holland, England and in the US.

This article will be broken down into seven parts:

1. **The Basics**
2. **Traditional Relief Valves**
3. **Lifespan, Provisions and Worldwide Legislation Examples**
4. **The Solution / The New Part**
5. **Compatibility**
6. **Economical Savings**
7. **Round-up**

**Please also note that some terminology and benefits may vary from country to country*

#Cavagna Classics

PART 1: The Basics

We assume that if you are reading this, you already know your stuff; perhaps you can even skip this part, if this is something you already know about, however, we find it quite interesting to start from the beginning!

So, let's start with the 'basics' of relief valves.

These valves are one of the most important parts of the LPG tank (Propane container). If, in the unlikely event, that there is an over pressure build-up, these valves allow the excess pressure to release into the atmosphere.

Commonly known as spring-loaded pressure relief valves, pop-off valves, pressure-venting valves or simply, relief valves. The operating principle of the relief valve is based on the possibility of being able to automatically discharge (without further interventions, apart from the pressure determined by the internal fluid) a certified quantity of fluid, in order to prevent the expected design pressure from being exceeded, with automatic interruption, of the discharge when the expected operating pressure is restored.

However, you probably already knew that if you found your way to this article!

PART 2: Traditional Relief Valves

To expand a little more on traditional pressure relief valves, shown in **Fig.1**, these are valves with an opening pressure regulation system based on the compression of a spring, they are held in the closed position by the force of the spring.

If the pressure rises to the pressure of the spring then gas will release to retrieve optimum pressure. If the pressure rises above that of the pressure of the spring, the valve will open. Once the pressure is released and the tank pressure falls below that of the spring, the valve closes.

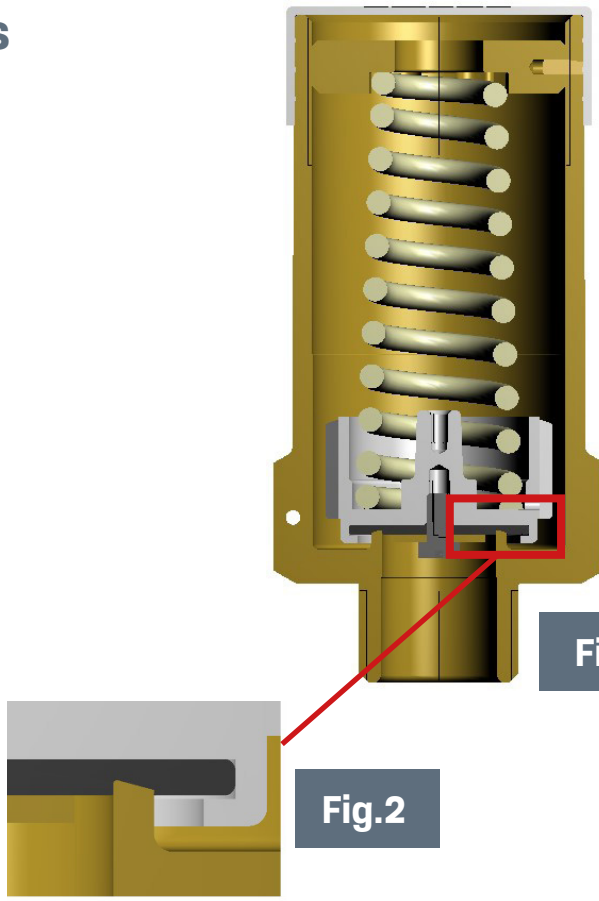


Fig.1

Fig.2

Smart right?

The size of the valve orifice is calculated in such a way as to guarantee an adequate section suitable to the discharge capacity required by the application and the shape/size guarantee the closing of the piston on which is actuated by the calibration spring.
The load value of the calibration spring, which contrasts the force exerted on the piston by the pressure inside the tank, is very high.

For example: to obtain a 17 bar calibration on an average size valve with a 24.5 mm diameter orifice, the spring load is approximately 85 kg.

The direct action of the spring on the piston consequently induces a powerful stress on the sealing element mounted on the piston, which is made of a rubber compound, and over time, causes it to deform and take on the shape of the valve orifice, thus affecting the value of the initial calibration (**Fig.2**).

In some cases, the deviation between the initial pressure and the intervention pressure of the valve in operation, exceeds the established designed value and the valve must be replaced.

In this occurrence, the situation requires that some periodic operation tests (M.D. 329/04) be carried out, which, of course, come with some considerable expense. The costs for such interventions may even further increase if the valve does not meet the foreseen calibration parameters.

It is important to note that the piston is subject to the highest stress when the valve is stored in a warehouse or when the valve is fitted to an empty tank; (i.e. without any internal pressure) this exerts a thrust onto the inner part of the piston, which partially balances the thrust exerted by the spring.

PART 3: Lifespan, Provisions and Worldwide examples

Here we will talk about the regulations; in regards to verifying calibration and substitution of valves. This is relevant to the rest of the article because this is where you can save yourself time and money based on what is globally required.

A recent complete study carried out in the US by the Battelle laboratory of Columbus on behalf of PERC (Propane Education & Research Council) of Washington has shown that already in the first 5 years of the lifespan, there are relief valves that have a calibration value beyond the expected parameters.

Country	Reference	Verify calibration	Subsitution	Note
Belgium	**Arrêté Royal 21.10.1968 art. 14.1.2**	**10 years**		**Org. accredited**
France	**CFBP MA.PV/PR.10 19/12/2007 § 5.3**	**10 years**	**30 years**	**Statistical control**
Italy	**DM n° 329 01/12/2004 Allegato A**	**2 years**		**ASL/ARPA**
Holland	**Overzicht van wet § 6.2**	**6 years**	**20 years**	**Lloyd**
Spain		**5 years**		
UK	**UKLPG COP 1 part 3 Appendix 1**		**10 years**	**5 years - if spring not stainless**
USA	**NFPA 59**	**5 years**		

The French ministry (article 23, § 2 de l'arrêté ministériel du 15 mars 2000) introduced the obligation for distribution companies to check the operation of the relief valves installed on LPG tanks in France.

The potential compromise on the application led to a statistical check required every ten years to verify the calibration value of the valves. The parameters required to pass the test were subsequently restricted and for the safety valves manufactured after 2007, the parameters provide that at least 20% of the safety valves must have a calibration value of ≤ 105% in respect to the nominal value.

USA

- NFPA 59 (Jurisdictional Systems) testing is required every 5 years. LP Gas companies have a variety of tank sizes, up to 30,000 gallon tanks. NFPA 59 covers containers greater than 4001 gallons where those containers are serving typically more than 10 customers; which are typically refer to as Jurisdictional systems.

- NFPA 58 (traditional retail) no testing requirement for relief valves – although the appendix in NFPA 58 "suggests" a relief valve could be tested test every 10 years , however is not considered ne-cessary. The exception could be for pilot operated relief valves for containers of 40,000 gallons or more.

- National board Inspection code (NBIC) – Some states within the U.S.A refer to this code. The NBIC also can apply to retail locations that are covered above in NFPA 58. Therefore, no testing required under NBIC jurisdiction and only inspected every 5 years.

- State of Virginia – (traditional retail) testing required every 10 years from either date code on relief or documented date of installation. This is still being evaluated by the state of Virginia. The first lo-cation for PV60 valves could be in Virginia, because of the Virginia Department of Labor and Indus-try (VA-DOLI) position regarding the testing requirements for pressure relief valves in ASME propane containers.

  Following the application of the provisions that have already led to the complete replacement of entire batches of valves, the Council for Fair Business Practices (CFBP) Association invited manufacturers to find solutions to ensure the stability of the relief valve calibration or to present solutions to reduce the negative effects that this situation entails.

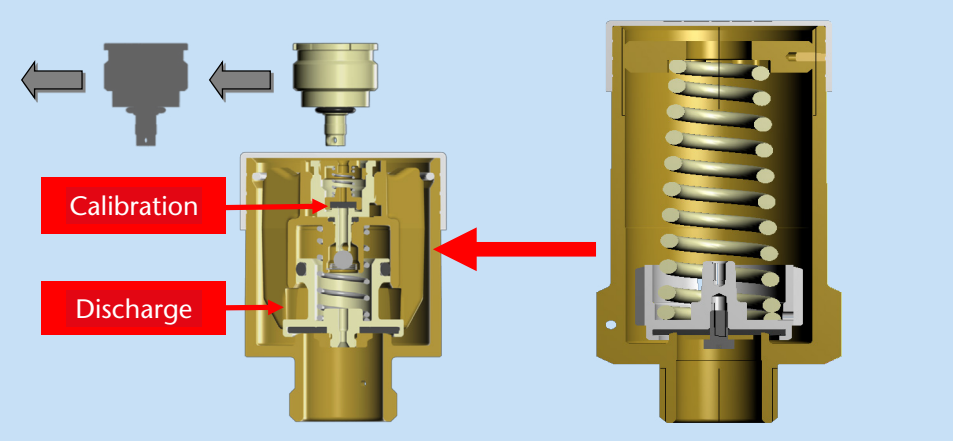
  Cavagna Group submitted a proposal that was approved and then developed, complete with the certification of the new model according to the European EC legislation and the CFBP technical specification for the authorization of the NF mark.
  Carrying out these routine tests require depressurization of the tanks, not only is this inconvenient and time consuming but the whole process is costly.

PART 4: The Solution and the New Proxy Valve (PV) Series

So if you skipped the first part, welcome back!

Here is where we offer you an improvement solution to the factors that come with the traditional relief valves and the 'hassles' that come from having to keep on top of the maintenance regulations.

The Cavagna Group LPG PV Series is a style of relief valve. This valve introduces an important feature, a **replaceable cartridge**, which means that you no longer have to depressurize the container to renew your relief valve.
The PV valve has both economic and operational advantages.



PV Valve with separate functions: calibration and discarge

Traditional External Security Valve

This design allows the user to replace the cartridge while the main body of the valve remains installed and the tank remains pressurized therefore eliminating the need to evacuate the container to replace traditional pressure relief valves.

The design of the PV Series also reduces the strain on the internal seals of the valve compared to ordinary relief valves. Now users can save time and money by replacing only the cartridge instead of the full valve, which can be done in as little as five minutes.

The relief valve PV has separate functions of discharge and calibration. The calibration function is fulfilled by a replaceable cartridge.

The new Cavagna Group PV valve series meets these four demands:

1. SAFE – It solves the problem caused by the excessive deformation of the sealing element, which is made of plastic (rubber) and assures the closure of the orifice of the pressure relief valve, thus reducing the phenomenon of initial calibration pressure change (reducing the "deformation / sticking" effect). Increases the guaranteed stability of parameter settings.

2. ECONOMICAL – Simplifies operations related to periodic service tests (or periodic calibration) as foreseen by the M.D. 329/04, thus considerably reducing the cost for the carrying out of such interventions, by a replaceable cartridge.

3. PRACTICAL – It is interchangeable with EU series valve and therefore can be mounted on the corresponding check-lock series valve.

4. ECO-COMPATIBLE – More compact than standard products on the market, important for space saving.

So what makes it different? Three things actually, let's get technical again...

1. Change of initial calibration

In addition to the above demands that have been met by the new valve, illustrated in **fig. 3**, it foresees a system, which assures a balanced distribution of the force exerted by the inner pressure of the tank to which the valve has been fitted, thus avoiding the use of a contrast spring with considerable load. So, the load of the spring (**3.1**) is about ten times lower than the load of the springs used on standard valves since it has only a 'return-to-closed-position' action for the main piston (**3.2**).
The condition of essential equilibrium of forces, which are produced by the pressure inside the tank, is achieved by means of the small hole (**3.3**) which connects the sliding chamber (**3.4**) of the main piston with the lower part of the orifice (**3.5**) and, therefore with the internal side of the tank.
In order to assure a prevailing force when closing, the chamber diameter (**3.4**) is slightly larger than the diameter of the orifice (**3.5**).

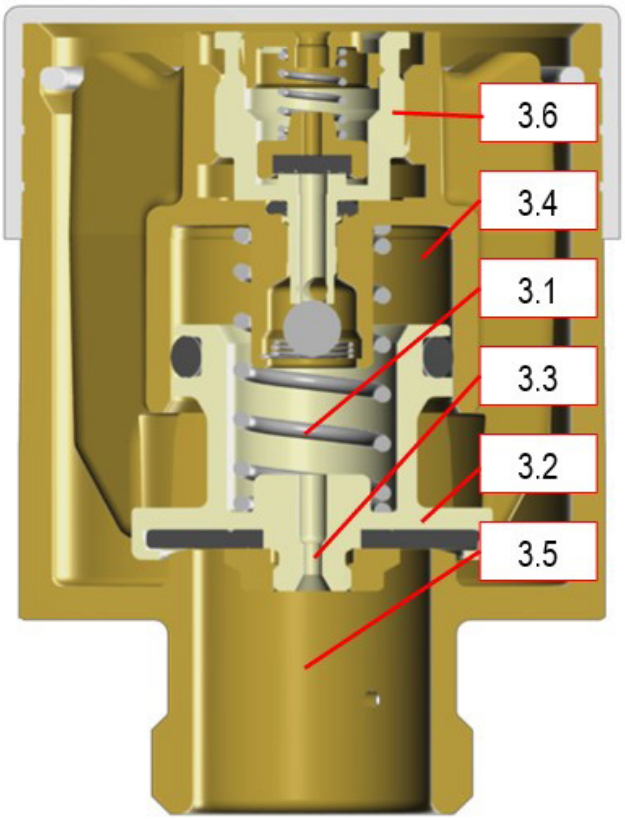


Fig.3

2. Valve Opening

The value of the opening pressure of the piston (**3.2**) and, therefore, of the valve discharging pressure, is determined by a small-sized ancillary valve (**3.6**) which does not need a considerable discharging rate of flow and can therefore be achieved, see **fig. 4**. With an orifice having a form (**3.6.1**) which can better resist the load of the spring (**3.6.2**) and, therefore, restrain the deformation of the gasket (**3.6.3**).

This condition makes it possible to maintain a more constant calibration value. The valve (**3.6**) has direct connection, by means of the passages (**3.6.4**), with the chamber (**3.4**) where the main piston slides (**3.2**).

If the inner tank pressure exceeds the set calibration value, the ancillary valve (**3.6**) opens and causes the pressure to lower inside the chamber (**3.4**) and, consequently, a predominance of the thrust exerted by the inner tank pressure onto the main piston (**3.2**) compared to that residing in the chamber (**3.4**)

This condition causes the opening of the main piston (**3.2**).

When the inner tank pressure reaches the reseat value foreseen for the main valve, the valve (**3.6**) closes and a pressure equilibrium is restored inside the chamber (**3.4**) which, depending on the predominance of diameter, causes the closing of the main piston (**3.2**).

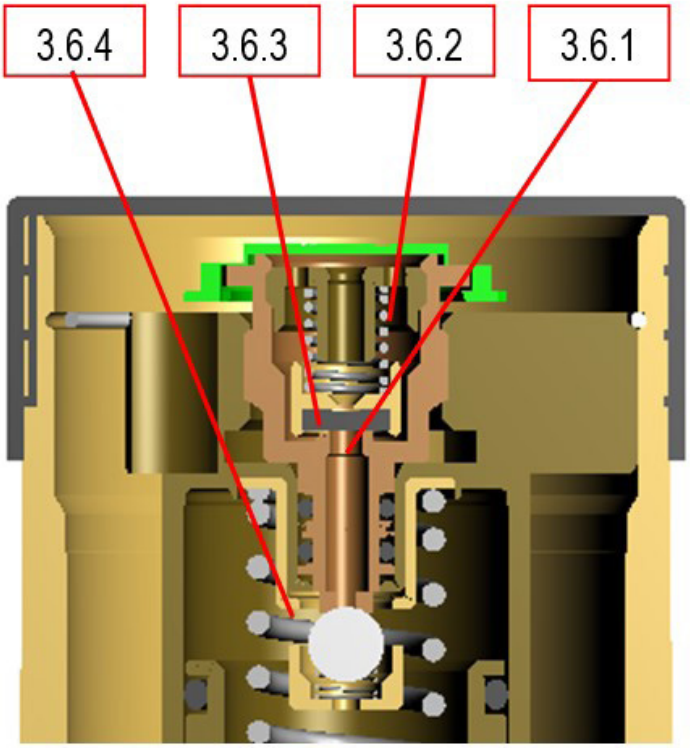


Fig.4

3. Replacement of the cartridge

Watch the **VIDEO** of the complete safety valve replacement and replacement of the calibration capsule.
Following these steps for periodical refurbishment of PV Series pressure relief Valves.

1. Remove the protection cap on top of the PV Valve;
2. Rotate the external wheel counter-clockwise until the internal brushing is lined up;
3. Insert the piston-locking device in the coupling position with the valve and rotate it clockwise;
4. Insert the PV wrench into the central bore of the piston-locking device;
5. Use the torque wrench in the PV wrench to lower the internal bushing in contact with the piston;
6. Manually rotate the PV wrench then disassemble the calibration cartridge;
7. Remove the old cartridge from the PV wrench;
8. Insert new cartridge to the PV wrench and screw the unit by hand;
9. Tighten the cartridge by using a 12 nm calibrated torqueing wrench rotating it in the opposite direction;
10. Rotate the hand wheel of the piston-locking device counter clockwise, in order to position the internal bushing flush with the upper plane of the hand-wheel;
11. Pull up the lower ring of the piston locking device upwards and rotate the piston locking device unit counter-clockwise to remove it;
12. Put the cap back on the valve.

When the process is being conducted, with the new PV valve series, it is not necessary to disassemble the whole valve from its check-lock. In fact, you can disassemble the ancillary valve (**3.6**) and replace it with a new ancillary valve, see **fig. 5**, to be sure that the functional parameters are assured.

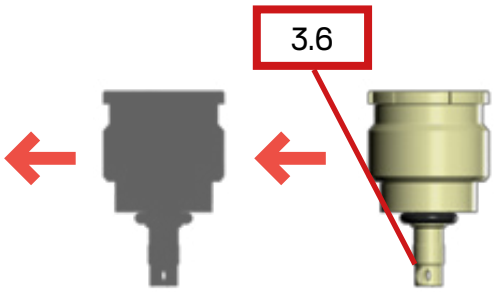
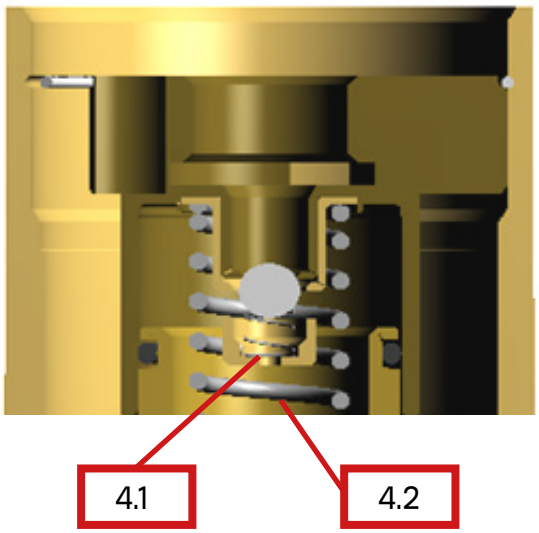


Fig.5

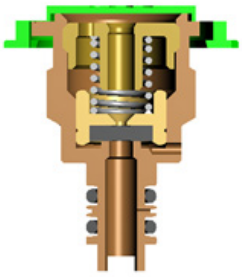
Fig.6



In this case, see **fig. 6**, upon unscrewing the ancillary valve (**3.6**), the ball (**4.1**) - pushed by the spring (**4.2**) - closes the passage between the chamber (**3.4**) and the seat of the ancillary valve, thus preventing any lowering of pressure and, consequently, the opening of the main piston.

The replacement of the ancillary valve (3.6), when the check-lock is present, can also be carried out by disassembling the PV series valve from the check-lock, replacing the ancillary valve (3.6) and re—assembling the main valve on the check-lock, by previous replacement of the bonded seal gasket between the valve and the check-lock.

There are significant elements of improvement regarding the operational aspect for the replacement and reduction of LPG dispersion during operation.



There is also a kit available from Cavagna Group to enable swift and easy changing of the cartridge.

Replacement Kit

PART 5: Compatibility

Interchangeability EU series / PV series.

The EU series valves and the PV series valves are interchangeable on previously installed tanks because they have been certified with the same check lock valve and have the equivalent characteristics.

Always check the compatibility of the sub-valve mounted on the tank with the safety valve model to be replaced and the discharge flow rate marked on the valves for compatibility with the tank dimensions.

Approved to multiple standards iuncluding; EN 14129 – EN 14071, UL 132 and ASME v8, AFNOR NF: CFBP MA.PV/ST29.

PART 6: Economical savings

Hey maybe you even skipped everything just to come to here! That is okay too, here are some good economic advantages to the switch and sometimes that can make all the difference!

Complying to the legislative requirements for periodic checks represent a cost that is certainly higher than the simple replacement of the calibration capsule, with a new one already provided with a certificate issued by the manufacturer.

As we said previously, the user can simply replace the cartridge without depressurizing the tank. Replacing the cartridge can be performed in as little as five minutes.

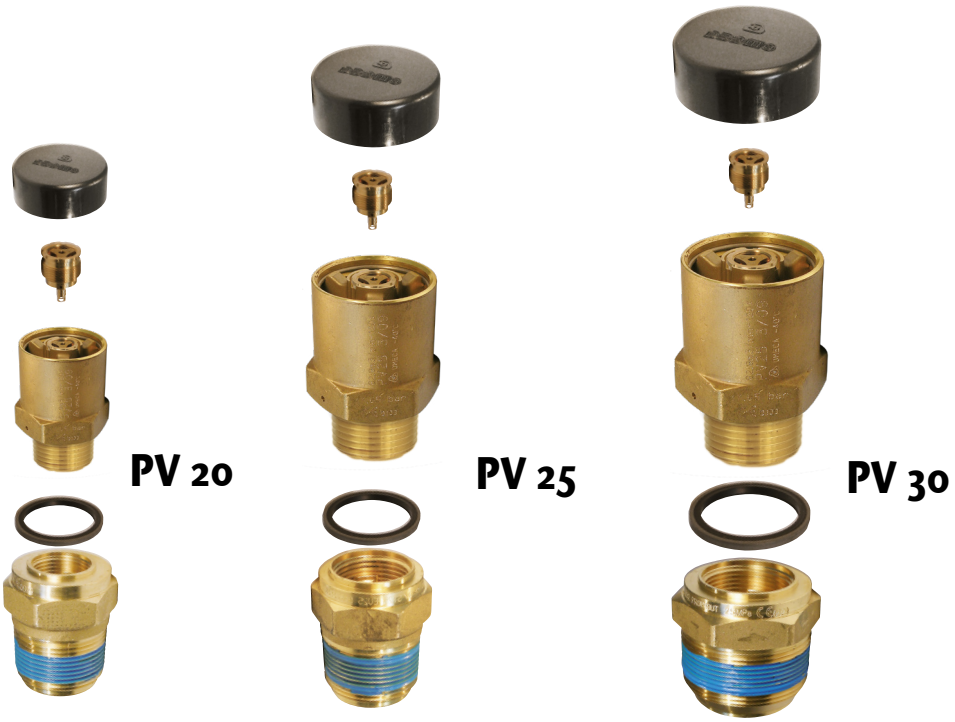
While the figures depend on your local regulations, it is clear to see that cost reductions are evident based on time and resourced needed for depressurizing a tank, the physical resources needed to do such and replacing the valve.

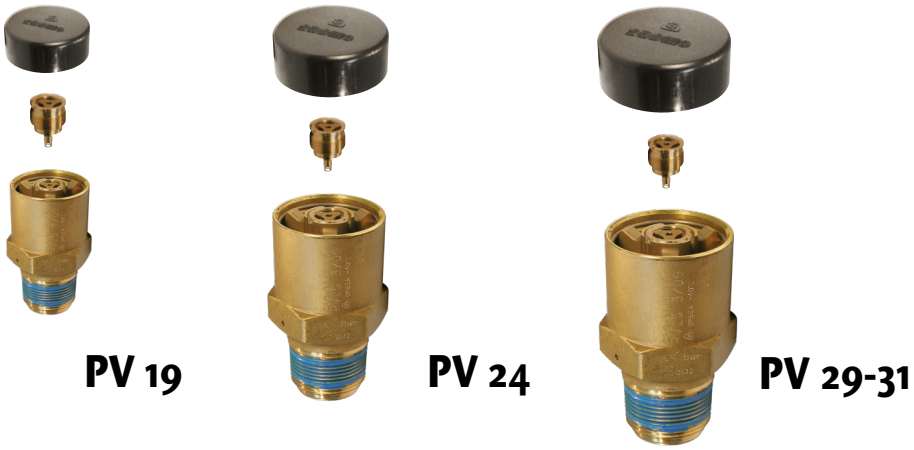
PART 7: Round Up

Understanding the real benefits of the switch is imperative to the overall savings that can be made.

The Cavagna PV series safety valves in conclusion:

- Facilitates the operations relevant to the two-year functional inspection foreseen by the M.D. 329/04 and drastically reduces its costs;
- Is interchangeable with the EU series valves, therefore it can be fitted to the relevant ST series check-locks;
- The stability characteristics of the calibration parameters Increases with time;
- Has a lower height with respect to the standard series, which are sold on the market;
- Provides a safe, tighter seal with less deterioration;
- Saves time and money by replacing only the cartridge instead of the entire valve;
- Means that tank evacuation for relief valves is no longer necessary .





PV 19 **PV 24** **PV 29-31**

If you would like even more (yes we have more!) information do contact your Cavagna Group Sales Manager.

Follow us on social media to keep up to date on new releases and articles coming soon.

About Cavagna Group

Cavagna Group is a world-leading manufacturer of equipment and components for controlling gases (energy gases, alternative fuel gases, medical gases, industrial gases, and speciality and cryogenic gases). It was founded in 1949 with headquarters in Northern Italy, close to Brescia, which is historically renowned for its metal processing industry.

The Group consists of eight vertically integrated production companies in Italy and eight others spread across the five continents.

The Cavagna Group now sells in more than 145 countries worldwide through a distribution network consisting of fifteen fully owned additional distribution companies. It boasts good business relations with major oil/gas companies, industrial gas companies, automotive OEMs, compressed and liquefied gas container manufacturers and gas appliance OEMs.

All this makes the Cavagna Group a truly reliable technology partner for the optimal use of gas, in terms of performance, safety and reliability, in different applications.