Gas Information Sheet No. 20

Over-pressure protection of LPG installations

An over-pressure situation can occur if a regulator becomes faulty. Such a fault can be caused by any number of reasons; mechanical failure, foreign body between the valve and its seat, diaphragm failure or blocked or under-sized vent opening.

If precautions are not taken to limit an overpressure situation, downstream equipment such as appliances and other regulators could be damaged and combustion could be affected.

Where does over-pressure occur?

Over-pressure situations occur when high inlet pressures are regulated to low outlet pressures. For example, the inlet pressure on a single stage regulator could be 1200 kPa (cylinder pressure) and the outlet 3 kPa.

If under normal operating conditions the outlet pressure rose to approximately 4 kPa, the regulator would "lock-up" and prevent any further rise. However, if the regulator valve did not seat properly, the inlet pressure (1200 kPa) would pass down-stream into the consumer piping.

The rise in pressure could damage appliances or components and cause gas leaks. Burner flames become enlarged or unstable and unsafe. It is very important therefore to maintain a safe gas installation by protecting against over-pressure and preventing its consequences.

What is over-pressure protection?

Over-pressure protection (OPP) is defined in AS/NZS 5601.1: 2013 Gas Installations as - "*A device or system for preventing the pressure in gas pipework or in gas appliances from exceeding a predetermined value.*"

What does OPP do?

Over pressure protection prevents the pressure in gas pipework or in gas appliances from exceeding a predetermined value. It will ensure a safe situation exists in the event of malfunction or failure of any gas pressure regulator.

Any part of the gas installation that is incapable of withstanding the inlet pressure to its gas pressure regulator shall be provided with over-pressure protection.

Where is OPP required?

Refer to AS/NZS 5601.1: 2013, clause 5.11.2. Over-pressure protection shall be provided where the operating pressure at the inlet to a gas pressure regulator exceeds the maximum over-pressure of piping and components supplied by the regulator up to and including the next downstream regulator and14 kPa for LP Gas.

The over-pressure protection device shall ensure that piping and components supplied by the regulator up to and including the next downstream regulator will not be subjected to a pressure greater than the maximum over-pressure for that piping and those components.

Maximum over-pressure

The maximum over-pressure is the maximum pressure at which the installation or any particular portion of the installation, or individual component, including appliances, remains safe.

For each individual ***component*** the maximum over-pressure is the maximum over-pressure of the component (if known) or 1.5 times the rated working pressure of the component, if known.

The maximum over-pressure for any ***portion of an installation*** is the lowest maximum over-pressure of the components comprising that portion of the installation or the pressure to which that portion of the installation has been tested, if the pressures mentioned above are not known.

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Obtaining Rated Working Pressure

The rated working pressure of components can be obtained from the manufacturer's technical literature.

Methods of over-pressure protection

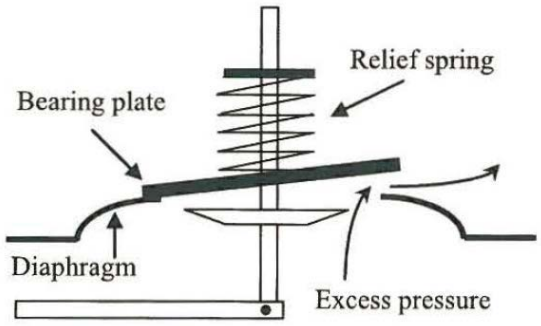
An OPP system can comprise one or more of a number of devices. The following methods are used in consumer piping systems:

(a) Pressure relief valve

Purpose made pressure relief valves have no other function, and gas does not flow through the device under normal operating conditions. A threaded relief outlet allows the connection of a vent pipe. It is essential that a relief valve be properly sized.

(b) Regulator with internal relief

These regulators have a spring-loaded relief opening in the diaphragm bearing plate. Two springs are located beneath the sealing cap and adjustment screw. The larger one controls the outlet pressure, the smaller one controls the relief pressure. In an overpressure situation, the pressure acting below the diaphragm (at a set point) overcomes the relief spring pressure and gas passes to atmosphere. Some regulators have full relief (under certain conditions) and others have partial relief.



Internal pressure relief

(c) Regulator with over-pressure shut-off (OPSO)

An OPSO device operates on the inlet to the regulator control orifice and shuts off the supply of gas at a pre-determined setting. Over-pressure is sensed on the outlet side of the regulator. Manual reset is required to restore supply. Some regulators fitted with OPSO also have internal relief and the OPSO setting must always exceed the relief pressure setting. For example, relief may be set to activate at 20% above required outlet pressure, and OPSO at 25%.

(d) Over-pressure slam shut

An OPSS device is installed as a separate component, usually located upstream of a regulator (1st or 2nd stage) with a piped connection to sense pressure downstream of the regulator. Alternatively it can be installed down-stream of any regulator if required.

(e) Other alternatives

1. Upgrade equipment

Where neither OPSO nor pressure relief is a practical solution, one alternative is to upgrade the installation using components with suitable rated working pressures.

2. Pressure switches

If a system is required on an appliance to protect against combustion problems caused by over-pressure, then a pressure switch can be installed downstream of the safety shutoff valves and wired into the safety shut-off system. The switch will actuate at a set pressure and cause safety shut-down.

3. Other methods

Any other proposed method should be discussed with ESV at design stage.

Other considerations

A decision will need to be made by the installation designer, piping installer or appliance installer as to which method of over-pressure protection will be most appropriate.

Because each method has advantages and disadvantages, the operational requirements of the customer must be considered, as must the cost of the system.

The following points may be of assistance:

- OPSO requires manual reset.
- Production problems may occur if the gas supply is shut-off.

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- The process of resetting may incur costs (call-out fees etc).
- High temperatures affecting consumer piping can cause an OPSO to trip.
- Gas emitted from a relief device may not be readily detected depending on the location of the vent termination point.
- Venting a relief device may be impractical. The length and route have to be considered.
- An over-pressure situation may not be apparent to the customer if gas is being vented to atmosphere. (May also result in high gas consumption complaints).
- Relief gas passing to atmosphere is wasted and contributes to the greenhouse effect.
- LPG is heavier than air and care must be taken to locate the vent termination point safely.

Selecting a regulator system

Before selecting a gas pressure regulator, the installer must establish the expected gas consumption and the most appropriate means of over-pressure protection. For example, what would be the consequences of supply loss caused by over-pressure shutoff?

Generally, domestic and light commercial installations are catered for by combined two-stage regulators with built-in overpressure protection, (internal relief) designed to limit downstream pressure to a maximum of 14 kPa under fault conditions.

When a two-stage system is selected, it is important to use compatible regulators.

The optimum system is to select a first stage regulator which has internal over- pressure protection. This regulator should be set to provide an outlet pressure of 70 kPa.

The second-stage regulator (with integral relief) will then provide an outlet pressure of 3 kPa or higher if required. Under failure conditions of either regulator, the downstream pressure will not exceed 14 kPa.

Nuisance tripping of OPSO

If nuisance tripping occurs, each spring should be checked against the manufacturer's specification. Ensure that the piping is not subject to excessive temperature.

Vent line

A regulator with internal pressure relief which is located within a building must be fitted with a vent line that terminates outside the building. Full details of the requirements can be found in AS/NZS 5601.1:2013, clause 5.11.5.

Generally, regulators with internal relief have a threaded vent opening. However, not all regulators with a threaded vent have internal relief because manufacturers often use a standard casting for a range of regulators. Some regulator vent openings are fitted with a removable insect screen.

Examples of various installations

Following are a number of scenarios and acceptable methods of providing pressure regulation and over-pressure protection.

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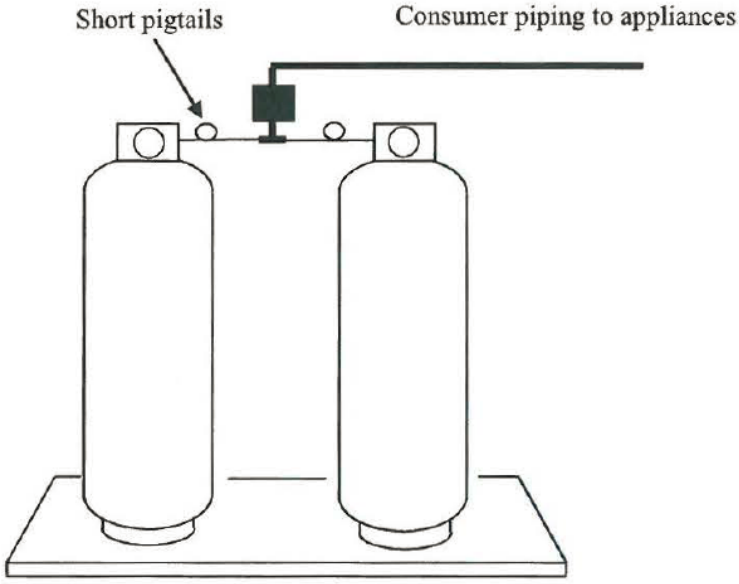
Scenario 1: Residential or light commercial

Maximum of two or three appliances, located near to cylinders



Set-up

Combined two-stage regulator with internal relief secured to wall or other permanent support. May be automatic or manual changeover.

Over pressure protection provided?

Yes, by means of internal pressure relief.

Testing for soundness (Refer to AS/NZS 5601.1: 2013 for details)

1. Test consumer piping without appliances at 7 kPa
2. Test consumer piping with appliances at 3 kPa
3. Test connections between cylinder and regulator with soapy water.

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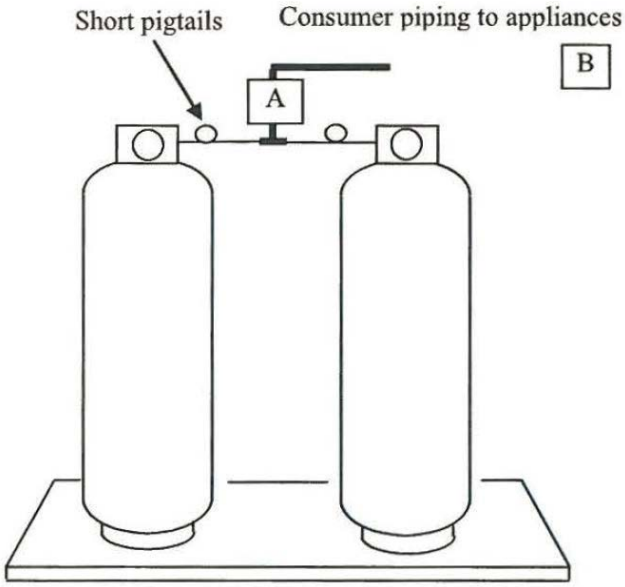
Scenario 2: Residential or light commercial

Maximum of two or three appliances, located away from cylinders



Set-up

1. First-stage regulator (A) with internal relief secured to wall or other permanent support. Set regulator to 70 kPa.
2. Second-stage regulator (B) with internal relief. Installed externally and secured to wall or other permanent support. Set regulator to 2.75 - 3 kPa.
3. Check burner pressure of each appliance.

Over pressure protection provided?

Yes, by means of internal pressure relief at both regulators. Provided first regulator is at 70 kPa or less, pressure downstream of second regulator will not exceed 14 kPa under fault conditions.

Testing for soundness (Refer to AS/NZS 5601.1: 2013 for details)

1. Test consumer piping between regulators at 105 kPa (70 X 1 .5) (Note: If there are no intermediate joints in the pipe, can be tested with soapy water at operating pressure).
2. Test consumer piping after second stage regulator without appliances at 7 kPa.
3. Test consumer piping after second stage regulator with appliances at 3 kPa.
4. Test connections between cylinder and 1st regulator with soapy water.

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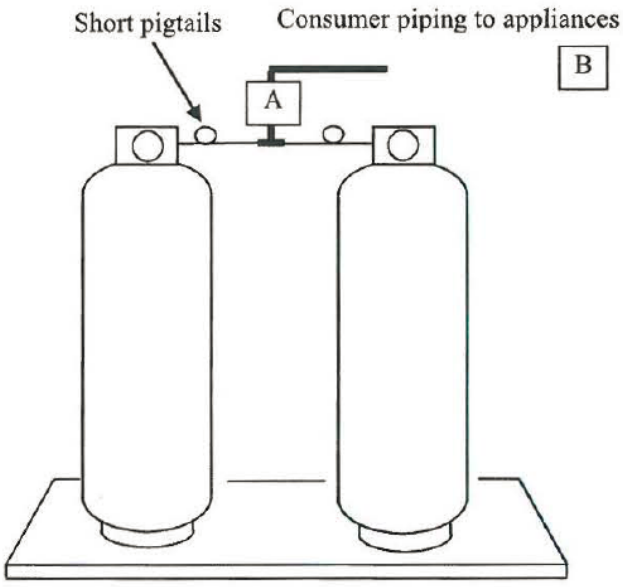
Scenario 3: Industrial or heavy commercial appliances located away from cylinders or tank.

Higher supply pressure required.



Set-up

1. First-stage regulator (A) with internal relief secured to wall or other permanent support. Set regulator to 140 kPa.
2. Second-stage regulator (B) with OPP installed externally and secured to wall or other permanent support. Set regulator to required pressure.

Over pressure protection provided?

The means of achieving over-pressure protection must be considered. The OPP setting should be approximately 20% above operating pressure.

Testing for soundness (Refer to AS/NZS 5601.1: 2013 for details)

1. Test consumer piping between regulators at 210 kPa (140 X 1.5) (Note: If there are no intermediate joints in the pipe, can be tested with soapy water at operating pressure).
2. Test consumer piping after second stage regulator without appliances at operating pressure X 1.5 and then with appliances at operating pressure.
3. Test connections between cylinder and 1st regulator with soapy water.

If further information is required, please phone the Gas Safety Technical Information Line on 1800 652 563.